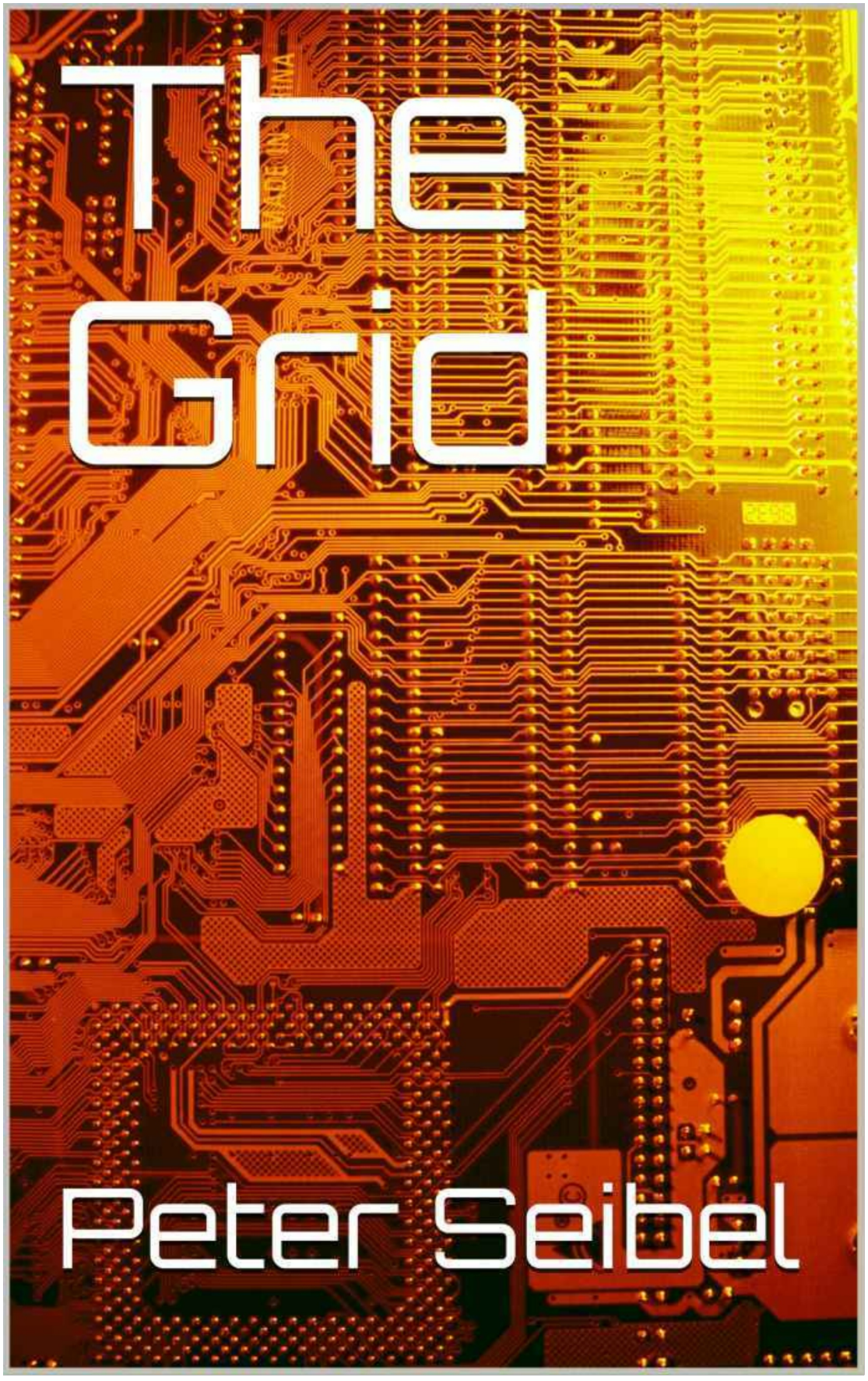
The Grid
Peter Seibel

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Chapter 1

Alan Gregoire sat in his office staring at a page full of computer code. He was tall and lanky. He had run cross country in high school and liked to walk rather than take the metro so he had not put on too many extra pounds, as so many of his co-workers had, from sitting all day at a desk. His office alternated between extreme tidiness and being an incredible mess. When he was in the midst of a project, as he was now, his desk would be littered with scraps of paper on which he had drawn obscure diagrams and written himself notes and todo lists. His whiteboard would be covered in more diagrams and notes and manuals and reference books would be strewn around on any available horizontal surface including the floor.

When a project was completed, all the scraps of paper would be swept up and invariably thrown out. The whiteboard would be scrubbed clean and all the books returned to their shelves. Then he would start again.

Alan was an optimizer. His job, day in and day out, was to find ways to make the software that ran on the Grid more efficient. In olden days, optimization had been just one part of programming. Indeed one of the most famous programming aphorisms had warned about spending to much time on optimization: “Premature optimization is the root of all evil.”

However optimization was no longer premature. Moore’s law, which for decades had described the approximate doubling every two years of the amount of computing power they could squeeze onto a single chip had ground to a halt and with it the free ride computer programmers had been on since the invention of the integrated circuit came crashing to a halt. And once folks discovered that the predictions of Peak Oil production had been right on the money and there was no longer enough oil in the ground to supply our needs, energy prices had started soaring.

Energy prices affected everyone but combined with the end of Moore’s reign, they spelled the end of an era for programmers and users of computation. Unfortunately lots of industries, to say nothing of the government, had become as addicted to cheap computing power as they had been to cheap energy: drug makers needed to model more and more complex compounds in their search for the next patentable blockbuster drug; the few giant financial companies to survive the public outrage of the late ’00s were back at it with ever more complex financial models and hair-triggered computerized trading algorithms. But now to double your computing power you had to buy again as many computers as you already owned and then you had to figure out how to pay for the electricity to run them.

Just prior to Moore’s Crash, as it was now called, computing had started to move into what was then termed “the cloud.” As computing moved onto the network anyway, from search engines to online merchants, some companies had become so good at running giant computing centers that they started to sell access to their spare computer cycles.

Soon it was uneconomical to compute any other way; the few companies that ran the giant cloud computing centers could turn watts into computer cycles more efficiently than anyone else on the planet and with the price of energy what it was, nobody else could afford to even try. To say nothing of the expense of buying computers: with the demand so high for computing power and the supply so limited, computer manufacturers raised their prices until only the biggest companies

—those running the Grid—could afford them. Most homes had what amounted to a smart TV—really just a slightly souped up version of the dumb terminals that had provided access to time sharing computing systems a century before.

Thus with computing cycles so dear, it was worth it to the folks who ran the Grid to pay Alan, and thousands of programmers like him, to search for tiny efficiency gains. As a consequence of several decades of this kind of optimization there were few left to be found and the code was such a maze of special cases and clever hacks that an optimizer might go weeks or even months without finding anything to fix. But every day they had to look over hundreds of lines of code, in painstaking detail, searching. Eventually every line of code would be examined by hundreds of optimizers and demerits awarded to those optimizers who had missed optimizations on their pass through the code. And the best optimizers got rewarded for their skill by being given the code that had already been combed over the most times—once all the lesser optimizers had taken a crack at it and found all the easy optimizations. On the other hand, the elite optimizers, of which Alan was one, did get to use computers to do their work—a few precious cycles could be used to help the optimizer find efficiencies in code that would be run billions or trillions of times. More junior optimizers, on the other hand, were afforded no such luxuries and had to make do with paper printouts.

Alan, his desk covered inches deep in diagrams and notes, was getting that itch that told him he was really close to finding something. He'd been on the trail of what he thought might be a major but very obscure optimization for almost a month. He had requested and been grudgingly allocated a few trillion cycles to run some automated analysis of a few thousand lines of code—he was pretty sure there was an interaction between a few disparate pieces of code that could be short circuited for fairly substantial savings but the code was so complex that he could only really be sure after an automated analysis. And even at that, the optimization, if it was really there, was so convoluted and esoteric that he'd had—and this had required an even more carefully worded request and had been given even more grudging acquiescence—to write a new function to be added to the code analysis library. He wasn't sure he personally knew any other optimizers who had been allowed to write new code.

His code had been running since before lunch and given the low priority his computation would be given by the Grid, he suspected he might have to buy a sandwich from the vending machine for dinner if he wanted to see the results before he went home for the weekend. He tried to distract himself with a pile of printouts —suggested optimizations from junior optimizers that he was supposed to check but he couldn't concentrate. He hadn't wasted any cycles on feedback from his program but he knew it would be done soon. If by some horrible chance his program took more cycles than he had been allocated it's state would be saved and he could possibly, with appropriate begging and pleading be given enough cycles to finish the run next week.

Just as he was contemplating that unpleasant scenario he glanced up at the screen and saw evidence of a much worse one occurring right before his eyes. Flashing on the screen was the following message: "GRID ERROR 4789. PROGRAM TERMINATED. NO RESTART POSSIBLE."

"Nooooo!" screamed Alan.

Chapter 2

What could have gone wrong? “GRID ERROR”? What the hell was that? Alan pulled a thick three ring binder off his bookshelf and looked up the error code. The description was hardly any more help than the message on his screen. It seemed a random glitch in the grid had killed his program, leaving no trace of its passing.

He might have been able to wheedle a few million more cycles out of his boss to finish a program that was almost done. But there was no way they were going to approve enough cycles to run the program all over again. “Fuck, fuck, and double fuck.”

Alan grabbed his beat up leather satchel and threw on his equally decrepit coat and stomped out of his office nearly colliding with the cleaning lady who was sweeping the hall outside his door. “Er, sorry.” Alan dodged her and strode down the hall to the stairwell.

Walking home, as was his habit, the cool air did little to cool him off. Alan still couldn’t wrap his mind around what had happened. A whole month’s work with nothing to show for it. He had been hoping this optimization would put him back to the top of the optimizers’ productivity chart. He was usually at the top but the past few quarters a few other senior optimizers had gotten particularly lucky and bumped him down a few notches, costing him a bonus he had gotten somewhat used to. This optimization was supposed to put him back on top. Now, all gone. He’d be lucky to get in the top fifty this quarter with a whole month spent on nothing.

After dropping his satchel at home and grabbing a battered novel to read, Alan walked to the nearby eating club where he usually spent his evenings. At thirty-five Alan was usually the youngest diner—most people his age would either be eating with their families at one of the many kid-friendly clubs or at one that drew a crowd of singles on the prowl. Alan had largely given up on marriage and kids and preferred the company of a good book. His club had somewhat the feel of and old time pub—he could nurse a pint and read for as long as he liked. He liked the hum of conversation among the other regulars talking about their grand-kids and their medical complaints. He never joined their conversation and they mostly ignored him beyond a brief nod hello.

The demographics of his club made it all the more strange when a woman probably ten years his junior entered the pub just as he was sitting down with a pint. Alan watched her walk across the room, wondering at what she was doing there. He noticed several other of the other male patrons following her progress across the club and not just because she seemed so out of place.

Stranger yet, after getting a pint herself and looking around the room, she walked straight to his table, ignoring the many empty tables nearby.

“Can I join you?”

“Uh, sure.” Alan gestured vaguely at one of the empty chairs, “Help yourself.”

“Thanks! Jennifer,” she said extending her hand.

“Alan,” he answered, shaking her hand. Her grip was quite a bit stronger than he would have expected; she was probably only about five foot five but taking another look he noticed that she was fit in a wiry but not at all unpleasant way.

“I don’t normally eat here,” she said, sitting down. “I just happened to be in the neighborhood this evening and saw it. Seems nice.”

“It’s quiet, anyway,” said Alan.

“Oh, I’m sorry. You probably want to read your book. Let me get another table.”

“No, no. Day I’ve had—I could use some conversation.”

“Rough, huh.”

“A bit. I won’t bore you with all the gory details. But I thought I was going to wrap up a big project I’ve been working on for a month and instead some glitch in the Grid basically wiped out all my work.”

“Whoa, what kind of work do you do that you get to use the Grid?”

“Oh, I’m an optimizer. I don’t normally get to use the Grid myself. But I had convinced my boss I needed to run a program to finish my project. Which it would have except for that glitch.”

“Wow. That sucks.”

“Anyway, I’m trying to not think about it. Can I get you another pint?”

“Sure. Actually, have you eaten yet? Want to get dinner?”

They got their food and two more pints and brought it back to the table. “So what do you do?” asked Alan after a few bites.

“Oh, a bit of this, a bit of that.” Jennifer pulled off her sweater and hung it over the back of her chair. Underneath she was wearing a low cut, tight top. Alan tried not to stare too obviously. “You know, I’ve never seen a real Grid terminal. Just in the movies. I’ve always been a little bit fascinated with that stuff—my grandfather was a programmer back in the days before the Grid. He always made it seem so romantic—creating worlds out of nothing but logic and math, building universal tools. Is it still like that?”

The way Jennifer was looking at him, Alan would have liked to have been able to say, yes. It’d had been a long time since he had been on a date, in large part because he was always so absorbed in his work and because almost everyone except other optimizers found it incredibly boring. Heck, even Alan and his fellow optimizers had a hard time talking with each other about their work. Yet here was a delightful twenty-something girl who wanted him to tell her it was romantic.

“Sorry. Those days are pretty much long gone. But hey, if you want I could show you a Grid terminal—my office isn’t far from here.”

“Neat.” Jennifer gave Alan a smile that made him wonder if he hadn’t given up on dating a bit too easily.

After finishing their food and busing their dishes, Alan led Jennifer out of the club and down the few blocks to his office. The night watchman gave him a conspiratorial grin as he signed them in but Alan ignored it.

Up the stairs and down the darkened hall to his office. Alan unlocked the door and let her in. When he turned the terminal back on it came back on right where he had left it: “GRID ERROR 4789. PROGRAM TERMINATED. NO RESTART POSSIBLE.”

“That’s the glitch, huh?” asked Jennifer. She leaned in close to peer at the screen.

“Yeah, that’s it.”

“What does it mean.”

“I don’t really know. It’s in the manual but it must basically never happen because the manual entry is hardly any longer than that message. Basically something went so badly wrong that not only did my program stop running but the Grid lost all track of what it had been doing. Normally if a program crashes, or, more likely, runs out of cycles, you get a dump of where it was and you can start it up again. But this time, no dump—nothing.”

“Shouldn’t you tell somebody?”

“Yeah, I was so pissed when it happened I just left. But yeah, they should probably know the Grid isn’t yet completely bug free. Man, I’m glad I’m not a debugger—pity the poor slob whose desk this lands on. Excuse me,” said Alan, as he slid into the chair in front of his terminal. Typing with a slow hunt and peck he issued the commands to dump out as much information about his program and the failed run as was available.

“Wow, does that stuff make sense to you?” asked Jennifer, leaning over his shoulder.

“Not really. But hopefully some debugger can make some sense of it. Though probably they won’t really be able to do anything with it—unless this has happened to a lot of other people, they won’t be able to budget enough cycles to reproduce it. They’ll just file away the information I’m giving them and some poor schmuck will have to compare my dump with any other dumps they have of the same kind of glitch.”

While Alan was talking, Jennifer stood up, pulled a small notepad and pen out of her pocket, and quickly copied a few numbers off his screen. She had just slid the pad and pen back into her pocket when Alan cleared the screen and turned around to say, “Well, anyway, here’s the Grid terminal—as promised. Thrilling I’m sure. Unfortunately I’m not such a big shot that I have cycles to spare to show you any snazzy Grid demos.”

“No, that’s okay. I just wanted to see one in real life.” She gave him a smile. “Thanks. Well, I’d better get going home—it’s getting late.”

“Can I walk you somewhere?”

“Oh, I’m just taking the metro.”

“Okay. I’ll walk you to the station.”

Chapter 3

Monday morning Alan was back at his desk. He had hoped to see more of Jennifer over the weekend but she had been busy. She gave him the address of her regular eating club and invited him to stop by some time for dinner but it was all the way across the city. He'd been too shy to ask for a more direct means of contacting her but maybe the fact that she hadn't offered any was supposed to tell him something about how unromantic she had found the reality of life as an optimizer.

When he sat down he turned his Grid terminal back on planning to see if there was any to salvage the situation from Friday. When he looked at his job history something was wrong. The last job should have been the one that ended with an error on Friday evening, but instead there was a job that had started around lunch time on Friday but which had completed *successfully* late Sunday night. That can't be right.

Yet when he looked at the results of the run, it was exactly the analysis he had been expecting on Friday evening when the glitch had struck. Before he did anything he sent the results to the departmental printer—he wanted them down on paper before he woke up from this dream or before another glitch came along and took them away again.

Walking down the hall to get his printout he wondered, was it possible that the only glitch had been something that had displayed the error message when there actually was no error and the job was actually still running fine? But how could his job have finished Sunday night? Even running at the lowest possible priority, his program would have burned through his allotted cycles long before then. On his way back from printer he poked his head into the office of a debugger he sometimes had lunch with.

"Hey Hank, how's it going?"

"Not so bad. How's the optimizing business? Put in any good bugs lately?" Hank liked to maintain that the Grid software was perfect and that the only bugs to be found were new ones introduced by the optimizers doing their jobs.

"You tell me. Can you look up a bug I filed Friday night?"

"Sure. Gimme your ID and the job ID."

Alan read the two numbers which were on the top of the printout he had just retrieved. They also happened to be the same two numbers Jennifer had written in her notebook.

"Here it is." said Hank. "What about it?"

"Can you just tell me if it really looks like something crashed?"

"What do you mean? It says it did. What else do you think happened?"

"Well, I came in this morning and I have the results from the run that crashed Friday night. System says it completed Sunday night."

"You're out of your fucking mind. I've got the crash report right here. And yes, there's the crash. Game over man."

"Well, I've got the printout of my results right here. Where did they come from?"

"Fuck if I know." Alan thought debuggers were supposed to be curious but Hank had already turned back to his own pile out printouts so Alan continued on his way back to his office.

When Alan got back to his office door, he paused with has hand on the doorknob and then decided there was one more person who might be able to help. Even less

often than he lunched with Hank, but occasionally, he'd eat with Bryce, one of the sysadmins. He liked Bryce and would probably eat with him more often if Bryce didn't, like so many sysadmins, spend almost all his time in the basement. When he got to the bottom of the stairs leading to the sysadmins' basement, the guard had to call Bryce for him—no one was allowed into the sysadmins' lair unescorted.

Bryce soon appeared at the door. "What the hell are you doing down here? Can't be time for lunch. I just finished my morning energy drink."

"I need your help with a problem."

"Oh, yeah. Well, I've got plenty of problems myself. What do I know about making the system run fast—I only know how the whole goddamn thing works."

"Well, this is really more of a sysadmin kind of problem I think. Can we go to your office?"

"Sure, whatever." Bryce led Alan through the maze of halls—behind many of the hallway walls were the rooms housing the machines the Grid ran on. Soon they were far enough in that even if Alan had been allowed to wander these halls unescorted, he never could have found his way out.

Bryce's office was dominated by a huge-screened Grid terminal. Sysadmins had essentially unlimited cycle budgets—paper was good enough for most optimizing and debugging but sysadmins had to be able to peer into what was actually going on in the Grid to keep it running. Bryce swept a pile of food wrappers off what turned out to be a chair and gestured for Alan to sit.

"So what's your problem."

"Have you ever seen a job fail and later come back to life and complete successfully?"

"Dude, I've seen everything."

"Okay, well I got a 4789 error on a job I was running Friday. Friday night I filed a bug about it and Hank upstairs says it really did crash. But this morning the system tells me it finished on Sunday night and I've got my results right here." He waved the stack of paper.

"Wait, a 4789. You sure you got that number right?"

"Yeah, I looked it up. I know the manual doesn't have much to say about it."

Bryce got up and shut his office door. "That's because we can't very well tell people what it really means." Bryce lined up some pencils on his desk. "Fuck. I shouldn't even be telling you this. A 4789 means an unauthorized user was detected on the node running your job and the whole thing was shut down and memory wiped in case they had planted any Trojan horses or worms."

"That can happen?"

"Well, we don't like to advertise it for perhaps obvious reasons. But yeah, it can happen."

"Who does that. And why?"

"Well, in the early days it was mostly kids—script kiddies they called them because they would find a script—a kind of program—that would automate some kind of attack. Being young and stupid they thought it was funny as hell to run the script and monkey-wrench the system. But we got things sorted out after a while. Plus the more computing moved onto the grid the harder it was for the script kiddies to pass around their scripts unnoticed. And when people started getting life sentences for monkey-wrenching it stopped being quite so funny.

"Nowadays the attackers are more serious and are probably organized. Some of the security weenies think there are two distinct groups with different goals—one just likes to bust things up, we call them the Vandals and the other has some more subtle goal. We call them the Underground."

“So some Vandal or Underground hacker breaks in and you wipe everything. Doesn’t that make it hard to determine how they got it in. What if that’s not the only node they were on?”

“Well, just before we wipe everything it’s dumped out to extremely secure and quarantined storage. There’s a whole crew of sysadmins who do nothing but analyze attacks like that. I mighta liked to have been one of them but I never could have passed the security clearance—those guys are basically monks.”

“Okay. So fine; I was an innocent bystander who got caught in an attack. And these monks, after they determined that nothing bad was going on, restarted my job?”

“No way. They almost never restart an attacked node. If it’s a big important customer, it’s easier to just refund them enough credits to run their computation again. And even if they wanted to, the number of hoops they’d have to jump through to get the dumped data from their quarantined systems back into the live Grid means there’s no way in hell that your job that crashed on Friday was back running over the weekend to finish on Sunday.”

“So how’d my job get restarted?”

“That I have no idea. Let me look into it a bit.” Bryce took the printouts from Alan’s hand and wrote down the same numbers Alan had given to Hank and that Jennifer had written in her notebook.

Alan went back to his desk and stared at the printout but couldn’t bring his mind to bear on whether the results showed his optimization would work or not. Instead his mind wanted to work on the problem of how his job could possibly been restarted if what Bryce said was right.

Somehow between Friday night when he was dead in the water and sometime Sunday, somebody had managed to get ahold of his program state which was supposed to exist only on some hard drive maintained by an elite core of monastic security sysadmins.

Running over the events of Friday night in his head only two things stood out as strange. The glitch itself and his spending the evening with a cute girl. A cute girl who had found him and somehow maneuvered him into taking her to his office to see his Grid terminal. A cute girl who, he now realized, had never really told him anything about herself. And who had even seen the error message and the bug report he filed. Was it possible that Jennifer of the firm handshake, thick red hair, and easy laugh had had something to do with the attack that had killed his job? And if that were possible, was it possible that she could have then had something to do with it being restarted when Bryce said that should be impossible?

Alan didn’t know what to think but he knew as soon as his shift was over, he would be heading to the eating club Jennifer had told him was her regular dining spot.

Chapter 4

As soon as he could justify leaving the office, Alan was out the door and rushing to the nearest metro station. He hoped Jennifer didn't dine too early.

The metro was packed with folks getting off early shifts and heading home or directly to their eating clubs. Almost everyone took the metro and ate at clubs. Only the wealthiest could afford to private transportation or to cook at home—like computing, cooking and transportation were fundamentally about converting energy into something else, edible food or motion, and just as computation had had to move onto the Grid to capture efficiencies of scale, so too had cooking moved out of the home and into eating clubs and transportation away from private vehicles and onto public transit.

Normally Alan avoided the metro, walking wherever he needed to go—it was his only exercise and he was naturally tall and thin and could walk all the way across the city in a less than an hour if he needed to. However tonight he was too worried about missing Jennifer if he got there too late, so he squeezed into the crowded metro car with everyone else and tried to think about what he was going to say to her.

Departing the metro station, he found the club a few blocks away. He had expected perhaps a club catering to young singles and had expected to feel out of place, but as he was entering the club he was nearly run over by a group of kids, seemingly ranging in age from about three to eighteen, running around playing some sort of game. "Sorry Mister!" shouted one of the older kids as he went running by. Seated around the club were adults of various ages—some just a bit older than the oldest kids up to folks old enough to be the grandparents or even great-grandparents of the younger kids. Everyone seemed to know everyone else and Alan felt even more out of place than he had expected to in a club filled with all young singles.

Looking around the club he spotted Jennifer sitting at a table, deep in a conversation with a group of people. His pausing in the door must have caught her attention because she looked up and saw him. He thought he saw a look of apprehension flash across her face but he couldn't be sure as it was just for a moment. She must have said something to the fellow next to her because he looked up at Alan with an appraising gaze. Then Jennifer smiled and gave a little wave.

Alan walked over to her table still not quite sure what he was going to say.

"Hey," she said as he walked up. He still couldn't place the emotion on her face. She didn't seem displeased to see him but neither did she seem happy.

"Can we talk?"

Jennifer nodded and gave a look to the man she had pointed Alan out to when he entered the club. He and the other people at the table got up and moved to another table.

Alan sat down. "Sorry to bother you. I just wanted to see you again."

"Really?" she asked. Alan started feeling queasy. This would be bad enough if she really was just a girl he wanted to see more of. But pretending that's what it was when he was really trying to figure out if she was some kind of outlaw hacker was way worse.

"I realized I must have spent all Friday evening talking about myself. I never really found out what you do. All I know about you is you had a grandfather who

told you romantic tales about the glory days of programming." He looked up at her, "And you wanted to see a Grid terminal in real life."

"Yeah. I really did, thanks for showing it to me."

"Why did you want to see it? Just because of your grandfather?"

"Well, mostly."

Alan thought he could see a faint blush on Jennifer's face. "Mostly? Why else?"

"I wanted to help you."

Alan boggled at her. "You didn't know me until you walked into the club. And how could you seeing my terminal supposed to help me."

"Well. I didn't know you but I knew you needed our help. You got your results today, right?" Jennifer now definitely looked embarrassed.

"*Our* help. You and who else?" Alan glanced over at the table where her friends had moved and noticed that several of them seemed to be observing their conversation.

"Some friends of mine. Look, I realize this is probably really confusing. It shouldn't have happened. But I can't exactly explain it here. Do you exercise?"

"Well, I walk a lot."

"Can you run?"

"Sure. Why?"

"Meet me at the forest gate tomorrow morning at six and we'll go for a run. I'll explain everything to you."

Alan got up and left the club. As he walked out the door he looked back and saw Jennifer's friends coming back to her table, asking her a question to which she shook her head looking unhappy.

Chapter 5

The next morning Alan was up with the sun to meet Jennifer for their run. She was waiting for him at the gate dressed in baggy pants, and a long-sleeved tee-shirt. She had a water bottle strapped to her hand.

"You have water?" she asked as he walked up.

"No. How far are we going to run."

"Oh, a ways. I'll give you some of mine."

"Where are your shoes?" asked Alan, noticing that Jennifer was in bare feet.

"Don't need 'em. You ready?"

"Ready as I'll ever be."

Jennifer started off into the woods running easily down the trail. Alan followed after her, finding himself surprised by her pace, much as he had been by the firmness of her handshake. He hadn't run regularly since high school but he soon found his rhythm and thought he could probably keep up with her without actually dying.

Jennifer soon turned down a narrow trail that left no room for running side by side so he followed her, wondering when they would have a chance to talk so she could give him her promised explanation. After about half an hour the trail widened and he pulled up next to her. He was beginning to wonder how much longer they were going to run but he didn't want to ask. Jennifer was still running quite easily. She took a glance at him and must have seen how he was laboring because she slackened her pace a bit.

"You know," she started, "human beings were evolved to be great runners."

"Oh yeah," said Alan, puffing a bit. "Then how come we're so slow."

"We're distance runners. Long before the invention of the bow and arrow, people used to hunt deer and antelope by running them down."

"You're smoking something if you think you can run a deer down on foot," gasped Alan.

"No, they did. It's called 'persistence hunting'. You spook a deer and it runs a ways off and then stops. If you can just keep it in sight you can catch up to it and it'll run off again but it can't run that far before it has to stop to rest. People can keep up with it over, literally, the long run. Eventually the deer will collapse from exhaustion and you catch it."

"How long does that take?"

"Oh, most of a day. And then you have to run home carrying the meat."

Alan suddenly began to wonder what he was doing running through the woods with a total stranger who was quite likely the member of an outlaw hacker gang. Was she tipping her hand how she was going to run him until he was exhausted and then leave him for dead in the middle of the forest, maybe after finishing him off by choking him with her surprisingly strong hands?

Just as he was beginning to work himself into a bit of a panic with this line of thinking, they ran into a clearing next to a creek and Jennifer stopped.

"Here. Don't drink too much," she said, handing him the water bottle and settling gracefully to the ground. "There's nothing to drink around here except what's in that bottle—that creek's pretty enough but it's full of heavy metals." He took a few sips and handed it back. Still a bit spooked by his train of thought about being left for dead, he found a rock to sit on that put a little extra distance between himself

and Jennifer.

"So you want to know how you got your results even though the Grid ate your job?"

"Yes."

"Do you know why the Grid glitched?"

"Yeah, someone was attacking the Grid and it noticed and booted them out, along with everything else on the node, my program among others. Was it you? Or your friends?"

"Attacking isn't exactly the right word. We were just using it."

"No, I was using it. You were breaking in. Why?"

"Freedom."

"Who's not free? I don't need to break into the Grid to be free."

"Maybe, you're not as free as you think. Do you know why that creek is so polluted that we don't dare put a drop to our lips? Or why nobody but the government and a few of the biggest companies can use the Grid? Why, even though the price of energy keeps going up, we keep burning the same crap we dig out of the ground rather than figuring out some other way to get our energy?

"Did you know that when computers were first networked together, long before the Grid, the people who built those networks thought they were building tools to unleash creativity and scientific exploration?

"And what do we use the Grid for now? You should know better than most since you get to look at the code. It's not science unless you count letting a few big companies who really make their money by converting externalized costs into profit continue to figure out how to do what they do.

"Back at the beginning of the century people were arguing about when we were going to hit the peak of our oil production. The people called pessimists at the time, said we already had. But some naysayers said we basically would never run out of oil. It's pretty clear now that it's getting harder and harder to find. But we keep using it because there's no alternative. Back then, there would have been a chance to find a way to get off oil but the big oil companies managed to keep them pretty well stifled. But it seemed eventually some new technology would come along and finally put Big Oil out of business. But before that could happen Moore's Law collapsed. It's hard to invent new technology without computers. You can't model a new, more efficient kind of wind turbine or a specially shaped mirror to focus the rays of the sun without a lot of computing power. And when computing became not just a commodity, as the futurists had been predicting, but an extremely expensive commodity, then only the biggest players could afford it. And they used it to keep their grip on power and on their profit stream.

"The people running those companies are destroying more value than they're creating but all the value is going into their pockets so they don't care. At the end of the last century the would-be oligarchs liked to talk about "trickle-down" economics—if they made enough money, they claimed, some would trickle down to everyone else and everyone would be better off. Now we're practicing "bread-crumb" economics—the folks at the bottom are making little enough as it is but as long as those at the top can gather up most of it, leaving just enough crumbs for everyone else to subsist on, the elites can maintain their way of life."

"Whoa there. What does that have to do with my job getting glitched out?"

"Don't you see? If we're going to avoid having the planet destroyed by greed heads we need to take back the Grid. And some of us are trying. I was working on a crack on the node running your job when we were detected and booted."

“So fine—you’re part of some hacker underground. And my job was collateral damage to one of your cracks. But how did you get me my results? I thought as soon as you were booted the machine was wiped.”

“Oh man. I should have listened to those guys. I can’t really explain it. I shouldn’t have even told you what I did. Actually really I shouldn’t have even restored your data.”

“But you did. It’s a bit late to put the genie back in the bottle.”

“Yeah. Well, basically the crack we were running, we were dumping memory ourselves in case we got wiped. Then when we get detected we haven’t lost all our work. Your job, and everything else on the node, was in our dumps—at most we would lose a few minutes between the time we finished our last dump and the wipe. All I needed was your user ID and job ID to find your job in the dump and restart it on another cracked node.”

“Which you got when you tricked me into showing you my terminal last night.”

“Well, yeah.”

“But why? You don’t know me from Adam. Why restore *my* job.”

“Well, we do know you, sort of. We’ve been watching you and we hope you might join us.”

“Join you? Are you quite mad?! What on earth makes you think I have any interest in joining some band of computer revolutionaries? And what do you mean watching me?”

Jennifer fiddled with the cap of the water bottle for a few moments. Then she said, “First we noticed your code. When we crack a node we can check out the code that’s running on it, decompile it. We’re always on the lookout for clever hacks and trying to understand the Grid better. We have file drawers filled with printouts of clever bits of code we’ve found over the years. Recently we happened to gain access to a node running a job for your department. In that job was data about work assignments in your department. Someone thought to correlate that data with our library of clever hacks. Your bosses obviously think you’re a top optimizer—they wouldn’t waste cycles on a project like your latest optimization if they didn’t. But in our judgment based on all the code we’ve looked it, you are not just *a* top optimizer, you are *the* top. You are responsible for over eighty percent of the highest rated optimizations we’ve collected. No one else has more than one percent.” She looked up at him a blushed a bit. “You’re a bit of a celebrity, actually.”

For Alan, who habitually ate dinner with no more company than a good book, and who usually felt like just another anonymous cog in the machine, to discover that he was a celebrity among a group of people whose existence he hadn’t even been aware of twenty-four hours earlier struck him as more creepy than satisfying.

“Anyway,” continued Jennifer, “Once we figured out that you were the one responsible for so many great hacks, we started trying to learn more about you. In olden days we probably could have cracked into a few online accounts and found out everything we needed to know. These days, we have to do things like pre-computer-era spies.”

“So I’ve done a few good optimizations. I don’t imagine you’re doing all this snooping around because you want my autograph. What do you want?”

“Like I said, we want you to join us. Someone with your talent, we’d like to have on our side regardless. But we also need people with inside access. Unfortunately most people working on the inside are, by definition, not the revolutionary type. We think you are. You may not have dared to think it in these terms yet but you know the system is busted. Not the Grid but the whole system it enables.” Jennifer looked at him hopefully, fiddling again with the cap of the water bottle.

This was crazy. Sure there were things that could be better about the world but Alan didn't think he was the one who was going to fix them. He liked his work and he liked his novels and that was enough. He knew she was right about some of it—mostly the Grid was used by a few big companies. Just the other week he had optimized some code for modeling the earth's crust, trying to predict where the few remaining oil deposits would be. And some of the government code he worked on, where they tried to minimize the amount of code he would see, despite his security clearances, he wasn't so dumb as to not realize it could be used to track people in various ways that he'd prefer not to think about. But that was just the way things were. He didn't need to get tangled up with some bunch of crazy, barefoot-running, computer-hacking-and-cracking, revolutionaries. Life was, if not great, fine.

"No, thanks." As soon as he said it, Alan regretted it. He had forgotten that he was deep in the forest with no recollection of how to get out. But Jennifer looked more disappointed than angry and she got to her feet saying, "Alright, I'll show you the way out."

Chapter 6

The office of the CEO of the Grid Corporation, or Grid Co, as it was usually called, was almost an anachronism, a throwback to the days when every CEO was—or thought himself to be—a titan of industry and thus deserving of any perk he could imagine. The walls were paneled with rich dark woods, imported from halfway around the world in the days before the shipping costs would have been prohibitive, even for a company as profitable as Grid Co. Lustrous oriental rugs, in intricate patterns covered the floor. On the CEO's desk sat one of the newest, and largest Grid terminals available though it would have been covered in a thin layer of dust if not for the team of maids who descended upon the executive suite every evening to restore the offices to their natural pristine state.

The CEO himself looked as well as his office—tall as an executive should be, several inches over six feet but not enough to be gangly or freakish in any way. He was fit and tan thanks to hours spent on the tennis courts with his business partners and sometimes with the club's tennis pro, who was also his mistress.

Going by appearances, both his and his office, Tom Loundobros, should be on top of the world. But he was not. He was a nervous man. The founders of Grid Co had been, in fact, ruthless and savvy business men, to say nothing of extremely lucky, having had both the good fortune to have built a company that required great expertise in turning watts into computer cycles just a the moment when that became a sufficient task for a great enterprise and one that led itself to a natural monopoly and the infighting skills to make sure that their company prevailed over the few competitors they had in the early days after Moore's Crash made that expertise so immensely valuable. And the next few CEOs had been ruthless enough to manage to get themselves appointed CEO of this fantastically successful company, a plum job when most companies and indeed whole industries were undergoing massive shifts and disruptions due to the combined cataclysm of Moore's Crash and the beginning of the Energy "crisis" which was now in its thirty-eighth year. Grid Co was the only company to naturally thrive in the new environment; everyone else had to figure things out anew.

Loundobros was a nervous man because he was at the mercy of his board. Unlike most CEOs, who still maintained the ancient privilege of appointing most of the members of the board of directors whose job it was to evaluate the CEO and keep them in line, the CEO of Grid Co actually worked for his board. After the great industrial shakeout that had followed the Crash, many of the big industries that had figured out how to survive in the new order realized that Grid Co was a natural monopoly—the economies of scale made it what it was—but also one that they were totally reliant on. These were the energy companies who had a deep need for computing power to continue to squeeze energy out of the ever-dwindling supplies of fossil fuels on which they were dependent; big pharma and big food, and the social entertainment media. The CEOs of *those* companies that survived the great shakeup *were* still ruthless and savvy and they realized that either they were going to dance to Grid Co's tune or it was going to dance to theirs. Obviously, they preferred the latter. And thanks to the already-entangled web of interlocking directorates and the old-boy network, they were soon able to stack the Grid Co board with directors who would make sure that Grid Co would look out for their interests. Insufficiently pliant Grid Co CEOs soon discovered that their post was no

longer so secure nor such a plum as it once had been.

Today Loundobros was specifically nervous because of the recent security problems the Grid had been having and which his Chief Security Officer, Jack Jeseki, was having no success in tracking down. He desperately wanted to fire Jeseki simply because the man never did anything but bring bad news, but he didn't dare because he had no hope of finding anyone better. The only bright side was he could take out his frustrations on Jeseki, who was irreplaceable but also completely unqualified for any other job and thus unlikely to quit.

"Fuck, Jack! How many more cycles do we have to lose before you figure out how those Underground jokers are doing it?" Jeseki stood silently, presumably having decided to treat that as a rhetorical question, which it probably was. "You can't track them down because they're coming in on black market terminals. You can't stop them because you don't know how they get in. Is there anything you can do? The board is getting very antsy; it's not just the added cost to them, though of course they don't like that. What they *really* don't like is the idea that these Underground hackers aren't just a bunch of kids breaking in for the fun of it but people who are stealing computer cycles to *do stuff*. Stuff that might impact the other business interests of the members of my board of directors."

"If you would let me run more trace programs…" started Jeseki.

"Fuck that Jack. We're losing enough to these hackers as it is; now you want me to throw more down the rat hole of your trace programs so you can trace them back to the same black market terminals which we can never find in the real world. Time for a new plan." Jeseki tried to look thoughtful, as if he were thinking of a new plan, which just made him look stupid—he was a technical wizard but that was it.

"Don't strain yourself, Jack," continued Loundobros, "We've already got a new plan. As my grandmother used to say—well, my grandmother never said it, but someone's grandmother must have—you catch more flies with honey than with vinegar. We need to find someone, anyone, who's got a connection to this Underground. Lure them in, pay them, feed them well, give them girls, boys, girls and boys, whatever they want if they'll lead us to the rest."

"But how do we find them?"

"Jack, do you ever leave your office? There are places out there where people go to drink and eat and brag and commiserate and all the rest. You and your people need to get out there in the world and find someone—anyone—who knows something about the underground and bring them in and start unraveling this mess."

Chapter 7

“Jeremy, Jeremy, look at this!” The pimple-faced eighteen-year-old, Ronnie, beckoned Jeremy over to his desk. Jeremy glanced up from the printout he was looking at and raised a finger to indicate that Ronnie should wait a moment. Then he furrowed his brow as though he had just come across something confusing in the code he was looking at. Which he had, in a sense—all the code was confusing to Jeremy. But little matter, that was what folks like Ronnie were for. Jeremy was the cell leader of this cell of the Society for Preservation of Goodness and Destruction of the Grid or SPOGDOG for short. Due to the diffuse clandestine cell structure of the SPOGDOG organization Jeremy had no way of knowing where, exactly, his cell fit in the larger organization but he had to believe that he must be one of the higher ranking cell leaders. Once the Grid was destroyed all would be revealed.

“Jeremy,” said Ronnie with a bit of annoying whine in his voice. Jeremy stood up and walked over.

“What *is* it Ronnie?” he asked.

“Look at this code!” Jeremy and his cell members, Ronnie and Simon, were poring over printouts of Grid code that had been provided to Jeremy by Mr. Jones, Jeremy’s contact within SPOGDOG. Or rather Ronnie was and Simon pretended to while day dreaming about a girl he had seen several times at his eating club and Jeremy pretended to while contemplating his glorious future after the destruction of the Grid.

How the printouts were obtained Jeremy knew better than to ask. His cell’s task was to find any weakness in the code that would allow an attack on the Grid. Which Ronnie, if Jeremy could judge by his level of annoying excitement, may just have found.

“Look, look. See this, read call. That buffer was allocated *here*,” said Ronnie, flipping back several pages and pointing to some code in the middle of the page.

“I see,” said Jeremy, trying to figure out what code Ronnie was trying to point at. Simon, tired of pretending to look at code, wandered over to see what was going on.

“You see, right? That’s a fixed-size buffer,” said Ronnie, putting an emphasis on “fixed-sized” that Jeremy didn’t really understand and looking up at Jeremy gleefully.

“Ah, yes. I see. Though perhaps you’d better explain the significance of that to Simon here,” said Jeremy.

“This buffer is allocated to hold 100 characters and this read here,” said Ronnie flipping back to the original page, “fills it in without checking how much data it has been given. If it gets more than 100 characters, boom! buffer overflow and we own them!” Ronnie giggled a bit and took a deep pull on his can of soda.

Simon looked as blank as Jeremy felt but, as cell leader, it was his job to keep up moral. “Excellent work, Ronnie. I’ll be sure to point this out in my report.”

“Point it out?” exclaimed Ronnie, putting down his soda suddenly. “What are you talking about? This is what you’ve been looking for! This is it, the way in. From here you can make the Grid run whatever code you want, take over the system, do whatever you want.”

“Destroy it?” asked Jeremy eagerly.

“Uh,” replied Ronnie, “maybe. I don’t know where this code is from. If it’s something that runs on all the nodes, Yeah, possibly.” He looked off into space,

“Yeah, I’m pretty sure it could. You’d have to be sure to infect a critical mass of nodes within a timing window …” Jeremy tuned out the rest of Ronnie’s soliloquy. He didn’t care about the details—but if Ronnie was right this was big stuff. He was the cell leader that had finally found the exploit SPOGDOG had been searching for for years.

As his own cell leader had explained to him, SPOGDOG had been formed with one goal in mind—to preserve goodness and destroy the Grid. Which were really one and the same. The Grid was the tool that the government and the big companies used to enslave the people and as long as it functioned the people would never be free. If they could bring down the Grid, the government would collapse and a new, more just government could be raised in it’s place. Jeremy wondered what sort of position he might attain in the new revolutionary order.

Chapter 8

“How’d it go Jen?” asked, Greg, as Jennifer sat down. He was the young man who had been sitting next to her when Alan had come into the eating club the night before.

“Fuck. I thought he was ready.” replied Jennifer, putting down her spoon. “How can he not see what the Grid is doing to us—he’s smart enough.”

“No luck, then, I take it. I told you he wasn’t ready. Shame though. He’s a hell of a hacker. We could have used him.” Greg and Jennifer had briefly and disastrously dated. Now they just got on each other’s nerves as friends. Greg had taught Jennifer how to crack the Grid but now had to admit, at least to himself, that she was the better programmer.

He had learned to program from his father who had been an antiquarian. Something about it had appealed to him when he was a young boy—it was like crossword puzzles and chess and solving a maze, all wrapped up together. When he had learned he had had no access to computers—he had written programs on paper and executed them in his head. Sometimes his father would read his programs and point out errors, “Bugs, they used to call them,” his father told him. Soon he was finding the bugs in his father’s programs more easily than his father found the ones in his. And soon after that he was inventing algorithms of a complexity that his father could barely understand.

The second greatest day of his life had occurred when he was about twelve and his father had brought home, from one of the rare book shops he frequented, a somewhat tattered but beautifully bound boxed set of five volumes, entitled *The Art of Computer Programming*. Greg had studied those volumes, incessantly, filling notebook after notebook with code to implement the algorithms he found described there.

But even better, and certainly more important to putting him on the path he was on today, had been the day, when he was sixteen, that his father had brought home a dinner guest, Mr. Green, who, it turned out, knew something about computers and computer programming. Greg’s father said he had met him in another used book shop and had happened to strike up a conversation that had wound its way around to computers and Greg’s father had told Mr. Green about Greg and how excited he was about writing programs in his notebooks that he’d never be able to run. Perhaps that was all there was too it or perhaps his father had known exactly who he was bringing home.

Mr. Green, who had one glass eye that disconcertingly stared unblinkingly at Greg while he quizzed Greg about his programs, seemed impressed that Greg had already read most of the five volumes his father had brought home, which Mr. Green referred to collectively as “Knuth”. Greg noticed later that was the name of the author. As he was leaving he said to Greg, “Why don’t you bring your notebooks around to my office some lunch time so we can have a proper discussion about them?”.

The next week Greg had taken the metro downtown to the address the man had given. He was surprised to discover it was the office of a white shoe law firm. He had known the dinner guest had been some kind of rich business man but he wasn’t sure what a lawyer would know about computers.

“Ah Greg. Let’s see those notebooks then, ” Mr Green had said. Greg had handed him a small stack of composition books. Mr. Green took the top book off the stack and started glancing through it. In a moment he put the notebook down in the middle of his blotter and started reading more carefully. Greg had sat nervously. He had long since outstripped his father’s meager skills as a programmer and didn’t know anyone else who knew anything about it. This was the first time he had had shown his programs to anyone who could understand them.

Watching Mr. Green’s face was torture for Greg. His brow would furrow and then clear. His eyebrows would pop up in surprise; he’d frown at something and then the frown would be erased by an amused smile.

Finally he closed the notebook and looked up at Greg. “These are very good. Where did you get the ideas for these programs?”

“Some of them were exercises from the books my dad gave me. The rest I just made up.”

“How?”

“Dunno. I just thought about interesting problems and then tried to figure out how I’d solve them with a computer.”

“Would you like to run some of these on a real computer?”

Now it was Greg’s turn to ask how. Mr. Green explained that he had access to a Grid terminal that belonged to one of his wealthy clients. That was how Mr. Green had been able to dabble in computer programming despite being a lawyer.

In the following weeks Mr. Green took Greg to the office of this client every Thursday afternoon. He showed him how to log on to the Grid and how to submit his jobs. And Greg had to learn a new programming language—his notebook programs had been written in a made up language used in *The Art of Computer Programming* to illustrate algorithms; now he had to learn the language of the Grid and the details of how to enter and run his programs. He still wrote his programs in notebooks, but now they were in the Grid language. One Thursday, having mastered the details of loading and running a program with some trivial test programs, Greg typed in a more complex program he had written out in his notebook the previous week, figuring it would be smooth sailing from there on out.

Hardly! He was astonished and discouraged to discover that his most carefully crafted programs, based on the ones that Mr. Green had said were so good, simply didn’t work. He spent hours trying to figure out what was wrong with his first program. He finally got it working but was so discouraged that when Mr. Green came to fetch him he told him, “I’m not sure you should waste your friend’s cycles on me. I’m no good at this.”

“Why do you say that?”

“My program didn’t work.”

“You mean you never got it to work?” Mr. Green looked a bit concerned but not overly so.

“No, I did,” admitted Greg. “But it didn’t work at first. There were stupid mistakes everywhere. And they were so hard to find. I thought I was good at this but I guess only when I’m writing programs on paper.”

Mr. Green laughed. “Greg, that’s called debugging. Nobody has ever figured out a way to avoid it. As one of the early computing pioneers once said: ‘As soon as we started programming, we found to our surprise that it wasn’t as easy to get programs right as we had thought. Debugging had to be discovered. I can remember the exact instant when I realized that a large part of my life from then on was going to be spent in finding mistakes in my own programs.’ If you’re going to be a programmer, you’re going to likewise spend a large part of your life finding mistakes in your

own work."

That had jolted him a bit. Was he going to be a programmer? Was anyone a programmer anymore? He loved writing programs in his notebooks but he thought it was an idle intellectual hobby, like writing poems that were never going to be published. From what Mr. Green had told him, even the folks who worked on the Grid mostly weren't programmers any more. There were optimizers who made existing code go faster and debuggers who searched for problems in existing code but very little new code was ever written. There must be some but Greg had no idea how one got to become one of the people who wrote it.

"How does one become a programmer?" he had asked Mr. Green.

"Well, there are two ways. You can go to school, study programming theory—which would bore someone who has already read and understood Knuth to tears—and then get certified in Grid programming—again major boredom—and finally get a job at one of the few companies big enough to need new software. Then you'd have to work for them as a junior optimizer or debugger or something for several years. But in a decade or so, if you're in the right place at the right time, you might be able to move onto the programming staff in a very junior position and get some minor programming assignments. Then, if you play all your political cards exactly right, by the time you're fifty you might be high enough up to be responsible for the overall design of a new program."

"I think I'd rather just keep writing programs in my notebooks and get a regular job. What's the other way?"

"You could join the Underground. We have a few computers of our own that are not part of the Grid. And we have ways of accessing the Grid from time to time." He did not elaborate on what those ways were, at that time.

Greg had desperately wanted to keep getting his hands on an actual computer. While writing programs in his notebooks would be better than slaving away as some kind of programming drone for a giant company, writing programs on a real computer, even with the hassles of getting a program to actually work—or maybe even because of them—was thousands of times more satisfying. So he had joined the Underground, in which Mr. Green turned out to be a bit of a big shot. Under the tutelage of the Underground's hackers, as they preferred to be called, he quickly became one of the best programmers Mr. Green, or anyone else, had seen. Until Jennifer had come along.

Chapter 9

Jennifer had also been found by Mr. Green, brought to his attention by a friend of his who taught freshman math at Jennifer's high school. The teacher was not part of the Underground; she just knew Mr. Green was always interested in meeting young people with a certain way of thinking and had become fairly good at picking them out. It wasn't just that Jennifer, like most of the other kids this teacher had sent Mr. Green's way, was terribly good at math. She also had the same kind of relentless focus and dissatisfaction with illogic and inefficiency that Mr. Green seemed to value so highly. Unlike many of the others, however, Jennifer wasn't socially awkward. She had many friends and had inspired crushes in dozens of boys as soon as she had entered high school. She was also as interested in history and literature as she was in math.

Since she knew nothing about programming when he met her, Mr. Green had had to bring her along more slowly than he had Greg. He started by appealing to her interest in history, loaning her books from his library about the early history of the Grid. This was stuff that got glossed over, as the more unsavory bits of history always are, in the version normally fed to high school students. Then he loaned her some books on the history of science before the Grid, eventually leading her back to the pioneering work of Alan Turing and his shameful death at the hands of British authorities. Then he sprang his trap and suggested she might be interested in looking at some of Turing's papers on computer science. And, as he expected, she sucked them right up. He kept her going, feeding her papers on computer science from his own extensive library which she continued to devour at a ferocious rate until, by the end of her senior year in high school she had what would have been the equivalent, in the old days, of a graduate level education in computer science. And she hadn't even touched a computer yet. For her, it had simply been the perfect mix of history and mathematics.

Then there was nothing to do but actually expose her to the machine. Greg, by this time, had been a member of the Underground for three years and was the youngest and generally considered the most talented programmer they had. So Mr. Green asked Greg to show Jennifer how to program. When Greg had joined the Underground, he had blown past the hackers who were teaching him to program, none of whom were dummies, so quickly that they called him Freight Train. Now he felt like he had been run over by one. Not only did he not have to explain anything to Jennifer more than once, he usually didn't even have to explain it once —he'd get part way through and explanation and she'd say, "I get it!" and be off and running. Soon she had her own notebooks filled with programs.

Finally, remembering his own sobering experience the first time he tried to write a program of any complexity on the Grid, Greg asked Mr. Green if he could let Jennifer do some actual programming on the same Grid terminal he had started out on. Mr. Green had been delighted to arrange it.

Greg told her a week in advance that they would be going so she could prepare a program. He had already taught her the Grid programming language and he would be there to help her through the details of entering and running the program.

When they arrived he asked her what program she wanted to try. She described a program that was at least twice as ambitious as his first real program, the one that had almost made him give up. He smiled to himself and said, "Okay, let's enter it."

Once the program was entered and ready to run, he asked, “You ready?”

“Yup.”

“Okay, hit ‘run’.”

And she did. The program stopped almost immediately and Greg worked hard to hide his smile. “Let’s see what went wrong,” he said. Jennifer was already flipping through her notebook and staring at the code on the screen.

“Ah, I see it,” she said. She made a small change to her code. “Typo.”

“Okay, try it again,” he said taking a sip of his coffee. And she hit ‘run.’ And it ran. Moments later it finished and spit out the answer and Greg almost spit out his coffee all over the terminal.

“You’re right,” she said, turning to him with a glow on her face. “It’s a lot more fun when you actually get to run them.”

Chapter 10

When Alan returned to work after his run he couldn't stop thinking about what Jennifer had said. He was a naturally cautious person. It's part of what had made him a successful optimizer—his optimizations almost never broke things because of the care he took with them. There was no way he would have accepted her offer to join the Underground on the spot. But once he had escaped from the woods and was able to think clearly, he realized there was something to what Jennifer had said. And there had been something about Jennifer herself.

Hank the debugger popped his head into Alan's office. "Hey, Alan. I tried to look into that bug for you. They tell me when you get a 4789 there's nothing we can do—we just log that it happened and move on as there's nothing left to debug. Sorry, pal."

Alan wondered how many people knew what a 4789 meant. Hank clearly did not. Did Hank's supervisor? Did any of the debuggers? Clearly the sysadmins did. And Bryce had told him, but they were pretty good friends despite Bryce's crusty manner. So how come he had never even heard of the possibility of attacks on the Grid before. And if the security weenies were right, there were two organized groups out there. And now he personally knew there was at least one. At least Jennifer hadn't been a member of the Vandals. Of course if she had, he would never have known because she wouldn't have tried to fix the thing she had broken.

So was the Underground really so bad? Alan usually tried not to think about it but the world really was pretty messed up. He remembered his grandmother telling him about the "green" protests she had participated in when she was young, fighting against the despoiling of nature and destruction of the environment. He tried to imagine what she would think of the state of the world today. Everyone had gotten used to a new, worse status quo and assumed that that's how things were going to be from now on. But what if Jennifer was right and things were actually getting worse. Working for a big company himself—one of the ones that was part of the problem if Jennifer was right—he certainly didn't have any great confidence that they could solve any problems whose solutions required bold decisions and acting contrary to their own short-term interests.

He was still pondering these questions when Bryce knocked on his door and said, "Yo. Want some lunch?"

It was drizzling when they got outside so they went to Bryce's eating club which was closer. They got their food and Bryce choose a table away from any of the other diners. As they sat down Bryce said, "I think I know what happened to your job the other day."

"Yeah?" Alan wondered if it was possible that he really did.

"I was talking to a friend of mine, we went to school together but now he's a security monk. But he'll still chat with me from time to time. Anyway, I told him about your situation. He was pretty cryptic about it but I'm not quite as dumb as he thinks I am so I understood more than maybe he wanted me to. Anyway, it seems some of those crackers I told you about have figured out how to dump out memory before we wipe it so they can restart their own illicit jobs. Normally they just do this for their jobs which makes it hard to track when they get restarted because those jobs officially don't exist. He got all excited when I told him about our job getting restarted because yours was a official job. I'm pretty sure he thinks they'll be able

to track back from the node where you job was restarted to whoever's doing this." Bryce shuddered. "I'm glad I'm not them."

"What? Why? What's going to happen to them?" Alan tried to act nonchalant, as if his question was just idle curiosity. But he was suddenly hit with a vision of Jennifer in jail or even in some underground interrogation room being forced to reveal the names of other members of the Underground.

"Uh, Alan? Have you noticed how seriously they take security back at the shop? The big boys who use the Grid aren't going to be happy about hackers infiltrating the system and the bosses know that. Most of the time the security monks only get to play defense but once and a while they catch a break and can actually track someone down in real life. When they do, they want to make an example of them but since they can't do it in public—that would require admitting that there are people breaking in—they have to play hard ball so the word gets back to the people it needs to get back to."

Alan put down his fork. On the one hand he was now especially glad that he had declined Jennifer's offer to join the Underground. But neither did he like the idea of Jennifer getting in trouble because she tried to help him out. He looked at his watch. He and Bryce were eating an early lunch; there was still a chance he could get across town to Jennifer's eating club while she was still there, assuming she ate lunch there, and assuming she ate a normal time. But he had to try to give her a heads up.

He left the eating club and walked as quickly as he could without actually breaking into a jog to the nearest metro station. He just missed a train and had to wait ten minutes for the next one. By the time I got across town he was looking at his watch and hoping that Jennifer ate lunch late.

The eating club was only half full. A quick scan of the tables turned up no sign of Jennifer. Alan was about to leave when he recognized one of the people who had been sitting with Jennifer the first night he had come here, an older man who, he saw, as he came closer had one glass eye.

"You looking for Jennifer?" asked the man as soon as Alan approached.

"Yes," said Alan a bit taken aback.

"The other eye works fine, as does my brain—I saw you come in and talk with her the other night. You've never been here before. Now you come back. What's the most likely explanation?"

"Well, yeah. So, do you know where she is."

"And why do you want to know?"

"Uh, I'm a friend of hers and I have a message for her."

"Which is it? Friend or messenger? *I'm* her friend and I've never seen you until the other night. I think we'll go with messenger."

"Okay. Anyway, the message is important."

"I'll give it to her."

"Um, it's kind of … personal."

"Alright young man, I'll stop yanking your chain. I don't think I need to protect her from the likes of you—she can take care you herself, I imagine. You just missed her here. I don't know where she was going but I suspect if you go to the drinking club at 50th Street and Bradbury Ave around eight o'clock tonight you'll probably find her."

Chapter 11

Jeremy had the printout of the code Ronnie had found in his backpack. He had made Ronnie explain the bug and the potential exploit to him over and over again until he was confident he could he could rattle off all the details with sufficient authority to cover up the fact he was still a little fuzzy on how it actually worked.

He was on his way to see *his* cell leader, Salvador. Jeremy couldn't help but realize that Salvador wasn't usually too happy to see him. They didn't have to meet in person often—once they established a series of dead drops Salvador would leave printouts of code for Jeremy to pick up and give to his cellmates to analyze. They had a dead drop for Jeremy to convey back to Salvador any interesting findings but Jeremy hadn't had anything to send back in so long he wasn't sure he remembered the signal he was supposed to use to tell Salvador that he had left something in the drop. Plus, he couldn't bear to wait for the time it would take—what if some other cell had been given the same code and had found the same bug? Instead he had sent Simon to Salvador's home, posing as a misdirected delivery boy. Simon had slipped Salvador Jeremy's message requesting a face-to-face meeting. Luckily Salvador had had the presence of mind to hand the message back to Simon with a time and address on it. It was to that address that Jeremy was now bound.

When he got there, the back room of a tobacco shop, Salvador was already in a grumpy mood. "What do you want? How many times do I have to tell you that all communications are to go through our pre-arranged signals and dead-drops. Luckily I realized that only you would have recruited a cell member as stupid and clumsy as that guy you sent around."

Jeremy let the insult slide. He knew all would be forgotten once Salvador saw the printouts. "Sorry about that; I realize it was out of band. But I was sure you'd want to see what I've found ASAP." Jeremy was a middle manager. He knew how to schmooze when he needed to. He pulled the printouts from his bag but didn't hand them over right away.

"Well, what is it?" Salvador's impatience and rudeness made Jeremy's imminent triumph all the more satisfying.

"My team has found it," he said.

"Found what."

"*It*. What we've been looking for, an exploit to bring down the Grid."

Salvador looked skeptical. Jeremy was forced to hand the printouts over. Salvador flipped through them, looking at the places Ronnie had marked. "You found this?"

"Well, me and my team," replied Jeremy.

"Hmmm. Against all odds, you—or your team anyway—appear to have done what you say. I'll have to run this up the hierarchy but it looks good to me." He nodded to dismiss Jeremy but Jeremy wasn't having it.

"We'll want to be in on the attack, of course." He said.

Salvador made an exasperated noise. Jeremy was getting a little tired of Salvador's attitude. *His* cell had found the exploit. He wouldn't have Salvador taking all the credit with the SPOGDOG supreme council. But the clandestine cell organization, perfect for protecting the organization, also acted as an impediment to useful schmoozing. Jeremy didn't know anyone in the organization except Salvador; there was no way to go up the chain of command. Thus Jeremy needed to

make sure that his cell was involved in the actual exploit; if Ronnie was right and this weakness was significant enough to bring down the Grid there might never be another chance.

Jeremy realized that part of the problem was Salvador's jealousy of his achievement. Perhaps he'd be less threatened by an underling. Time to try a slightly different tack: "Certainly you'll want Ronnie from my cell involved. He's the one who did the majority of the work analyzing the bug. I'm sure he has ideas about the best way to exploit it." Jeremy figured there'd be no way for them to involve Ronnie without himself being involved too.

Salvador actually paused at that. "Mmmmmm. Perhaps you're right. Anyway, I'll pass all the information on up." He put the printouts into his briefcase. "Good work," he said grudgingly.

Chapter 12

Jennifer and Greg had been at the after-hours drinking club that Mr. Green had told Alan about for about half an hour when Ronnie and Simon came in. Greg and Ronnie knew each other a bit. Ronnie had once caught the attention of Mr. Green the way and Jennifer and Greg had, and Greg had helped teach him to program. Ronnie had demonstrated some aptitude but Mr. Green had ultimately decided he wasn't someone who should be invited into the Underground. Mr. Green never told anyone about the Underground who wasn't ready to be invited to join but there were enough people who had dropped out of the Underground to join SPOGDOG that eventually everyone in SPOGDOG knew about the Underground though they disdained it as insufficiently revolutionary. And since a good portion of SPOGDOG were Mr. Green washouts like Ronnie, the Underground tended to know about who was in the rival organization.

SPOGDOG had scooped up Ronnie after Mr. Green had let him drift away and eventually Ronnie found out who Mr. Green was and that he had not considered Ronnie good enough for the Underground.

"Come on Simon. Let's go buy a round for the Underpants crew," said Ronnie as the two entered the drinking club. Greg looked up until he saw who it was and turned back to Jennifer with no more sign he had heard than a slight tightening of his lips.

Ronnie led Simon up to the bar where they ordered their drinks and then they walked over and took the stools next to Greg and Jennifer. "What you guys drinking? Have another, it's on me." Up close it was apparent this wasn't the first drinking club Ronnie and Simon had hit that night. Simon was already a bit unsteady on his feet and even more spacey than usual.

"Hello Ronnie," replied Greg standing up, "Thanks, but we were just about to leave."

"Aw, come on. Stay," said Ronnie, putting his hand on Greg's shoulder and pushing him back onto his bar stool. Ronnie was big, a bit over six feet and probably fifty pounds overweight, and had the strength that came from simply having to carry that extra weight around all the time. Greg acquiesced while Jennifer looked on. "Come on, have another drink, on me. This is my big night."

"Why's that?" asked Greg. He had never seen Ronnie this exuberant before. Then again, he had never seen Ronnie drunk before either. But he also knew Ronnie was part of SPOGDOG. If Ronnie's mood had something to do with SPOGDOG, he should really find out what was up.

"Can't tell you." Ronnie signaled to the bartender to bring new drinks for Greg and Jennifer.

"Oh. That's some night. Well, congratulations!" said Greg, taking a mocking sip of his drink. Jennifer didn't touch hers.

"Hey, who's this? Your girlfriend?" asked Ronnie, leaning in close to Jennifer and giving her a not very subtle once over.

"I'm just a friend." said Jennifer quietly.

"That so. Maybe then you want to party with me and Simon. We're celebrating."

"Sorry, Ronnie. Like Greg said, we were just leaving. But congratulations on your big night." She said it with no hint of Greg's mocking tone. But for some reason it enraged Ronnie. "What do you know about it?" he asked angrily and

pushed her off her bar stool. Or that's what his body thought it had done right up to the point when he felt himself stumbling past her, almost falling to the floor before he caught himself on an empty bar stool several places down the bar.

He turned around and looked at her. She was standing up watching him. He saw Greg get up from his stool and then saw Jennifer touch him lightly with her hand and give him a quick look and he sat back down.

"Shit, I must be drunker than I thought. You bring your girlfriend with you to fight your fights Greg?"

"Oh, were we fighting?" asked Jennifer. "I thought you were just clumsy."

"Bitch." This time Ronnie gave her a real push, practically hitting her. But somehow Jennifer absorbed the push and the next thing he knew she had trapped his hand in both of hers and was bending his wrist into an excruciatingly unnatural position. The only way to relieve the pain was to collapse to his knees but she kept the hand trapped.

"Settle our tab, Greg. As we've both tried to tell Ronnie, we're leaving."

From his position on his knees Ronnie saw Greg throw some money on the bar and Jennifer standing completely relaxed though still holding his hand. He made one more attempt to stand up but a twitch of her hands doubled the pain in his wrist and he dropped back to his knees. "Okay, Ronnie," she said. "I'm going to let go of you now and we're going to leave. You be good and maybe the rest of your night will go better than it has so far." With that she let go and he cradled his throbbing wrist in his lap as she and Greg walked out of the club.

Alan, who had arrived just in time to see Ronnie's first attempt to push Jennifer, immediately turned around and followed them out of the club. They weren't running out of the club but neither were they dawdling and he had to jog to catch up to them in the middle of the block.

"Jennifer, wait."

"What are *you* doing here?"

"I need to tell you something. About the thing we talked about the other day," he added, with a look at Greg. Greg looked back at him with an amused look.

"It's okay. Greg can hear it. He'll probably be pissed at me, but he can hear it."

"Well, I was talking to a guy at work, one of the sysadmins, and he said he thought the security guys were going to be able to use the job of mine that you restarted to trace things back to you."

"See Jen, I told you, you shouldn't restart that job. When it's our jobs it doesn't matter, but a real job, that gives them just enough. They're not all stupid over there you know." He gave Alan a significant glance that Alan took to mean that he, Alan, probably didn't fall in the "not stupid" circle in Greg's mental Venn diagram.

"Shit. I still think they're going to have a hard time untangling the path I left them. I knew it was risky and used some extra precautions. But we'd better tell Mr. Green."

"Okay, but what do we do with this guy?" asked Greg, glancing at Alan.

"Hey, you don't have to do anything with me," said Alan, a bit offended. "I just came to warn you. I felt bad to think you might get in trouble because you wanted to help me out."

"Ignore Greg. He's a jerk." said Jennifer. "You can go if you want. But if you want to have a little fun there's a way you could help me out. Did you see that big doofus who was trying to push me around back in the club?"

"Yeah. Holy crap, what did you do to that guy? He was like twice your size."

"Just a little Tai Chi."

“Tai Chi? I thought that was for old people in the park. You kicked that guy’s ass.”

“Yeah, well, once again, you don’t know as much as you think you know. Anyway, Ronnie back there is a member of a group called SPOGDOG, The Society for Preservation of Goodness and the Destruction of the Grid. If you object to our attempts to use the Grid to save the planet, than you should really hate SPOGDOG—they just want, as their name suggests, to destroy it. They’re monkey-wrenchers pure and simple. Ronnie fell in with them after we decided he wasn’t right for the Underground. He’s not, his behavior to the contrary, a complete idiot. He was excited about something tonight and wanted to rub it in Greg’s face in particular. Which suggests it’s something to do with SPOGDOG.

“He’ll never tell us but he doesn’t know you. And right now he’s probably in pretty desperate need of an ego boost. Go talk to him; let him know you think the Grid is fascinating and he’ll probably tell you his life story, hopefully leading up to whatever thing happened today to make him so annoyingly happy.

“I don’t know.”

“Look, if SPOGDOG is up to something, your employer would probably want to know about it as much as we do. You could be a hero. You might even get a raise.”

“Okay, fine. But where will you be?”

“I’m going home, just a few blocks from here, number 8086. Come ring my bell when you finish up with Ronnie.”

Chapter 13

Alan made his way back to the drinking club. He wasn't quite sure why he was getting involved. There was something to what Jennifer said—if he didn't want to get involved in the Underground because he didn't think it was right to break into the Grid then wasn't he obligated to try and stop an attack on the Grid even if it meant involving himself, to some extent, with the Underground. Strange bedfellows and all that. Speaking of bedfellows—but Alan tried not to think of that. In particular he tried not to think of how Jennifer had looked when the had arrived in the clearing on their run the day before. Healthy. Fit. Glowing. But he wasn't thinking about that.

Instead he needed to think about how he was going to get Ronnie to spill his guts about what was going on with SPOGDOG. Inside the club he found Ronnie sitting a the bar gulping at a drink and grumbling to Simon who barely seemed to be paying attention. Luckily no one else was sitting near the two—presumably they all been witness to Ronnie's humiliation.

Alan took a stool one down from Ronnie and ordered a rum on ice. Ronnie turned to look at him, trying to discern whether Alan had seen the scene with Jennifer. Alan tried to give him a friendly nod but Ronnie just looked away. Alan was terrible at smalltalk and didn't hang out in drinking clubs much so had no idea the protocol for starting conversations with strangers was. His only saving grace, he figured, was that Ronnie looked to be even more socially inept. Plus he was already pretty well on the way to being hammered. Alan decided to try for a bold approach.

"Excuse me, are you Ronald Bilchuck, the computer programmer."

Ronnie looked back at Alan. "I prefer the term, 'hacker'," he sniffed, trying to reassert some sense of dignity.

"Right. Someone told me I might find you here. I'm a bit of a hacker myself—well, I don't know if I can rightly use that term myself. Anyway, I've read a bit about computer programming—I'm a history buff really, you see. Anyway, my friend told me you could tell me about how it's really done." Alan had a sinking feeling that he was getting more and more incoherent as he went. But Ronnie seemed to be almost physically reinflating, as he were a balloon and Alan's words were air.

"Oh, yeah. Who's your friend?"

Shit. "Well, he's not a friend so much as a guy I met that another guy told me knew something about programming. Tuned out he didn't, not really. But he told me you really did.

"Yeah. I know about it. What do you want to know," asked Ronnie expansively signaling the bartender for another drink. Alan also ordered another and when the drinks arrived, insisted on paying.

"Well, I'm just trying to understand how the Grid compares to computing in the olden days. From what I've read it used to be that computers were subject to all kinds of attacks, Trojan horses, viruses—'malware' I think it was called. But now everyone says the Grid is immune to those things. How did that happen? Did they just get smarter about how they build systems. It's all black magic to me. Can you explain it?" Alan did his best to look slightly dopey but very interested and hoped he was doing a better job than Ronnie, who was trying to look wise and sophisticated.

“Oh, no, they may think they’re smarter about things now but they’re not really. Any lock you can open with a key, you can also pick. You just have to know how.”

“Oh, and you know how?” asked Alan with as much excitement as he could muster. “I just thought you might be able to explain the theory of it to me. But you really know how those attacks used to work?”

“Sure, sure. And don’t be so sure it’s ‘used to’,” added Ronnie with a wink. He proceeded to give Alan a lecture on the various kinds of attacks on computers and networks techniques for achieving them, that would have been patronizing even if Alan had been the clueless history buff he was pretended to be. But even at that, Alan found that he was learning a lot. He might be, if Jennifer was right, one of the cleverest Grid optimizers around, but he had never given much thought to how to break into a computer. He had no need to and had never been the kind of person drawn to that kind of puzzle. He couldn’t help but ask a few questions which, if Ronnie had been paying any attention, would have blown his cover as a computer illiterate history aficionado. But Ronnie was just glad to have an audience that seemed as thoroughly enraptured by Ronnie’s brilliance as Ronnie was.

When Ronnie wound down his lecture Alan understood a lot better what kinds of thing SPOGDOG might be up to but no idea what, if anything, they actually *were* up to. One last try. “Wow, that’s really interesting. But that stuff couldn’t work today could it? I mean how would you even get started?”

Ronnie went on to explain how all you really needed was access to the code running the Grid. “That’s supposed to be secret but there are too many people who need to have access to it for it to really stay secret.” Alan could see how that was true. He tried to estimate how much of the Grid code he had looked at at one time or another. Buy off a handful of optimizers or debuggers and get them to take some pictures of each printout they get in the course of the work and probably pretty soon you’d have a nearly complete listing of the Grid’s source code.

“So you’ve got the code. But what do you look for? I don’t mean to pry but have you ever done this yourself? This still all sounds kind of theoretical to me.”

“Of course I have!” answered Ronnie angrily, “just today I found a buffer overflow exploit in the Grid’s inter-node communication protocol code. I send the right message to a Grid node and overflow that buffer and I could run anything I want on that node. And if I have the first node run some code to send the same message to other nodes, and so on, I could probably take over the whole Grid. Stay tuned!” he finished with a chuckle that was probably supposed to be suave.

“But to what end? What would you do with it if you did?” asked Alan.

“I don’t know. Just fuck things up. They’ll have to scurry around and fix it and they’ll see they’re not so smart after all.”

“But you wouldn’t really do something like that would you?”

“Sure why not?” asked Ronnie, looking genuinely puzzled.

To that Alan had no answer. He had asked merely to stay in character. He could tell that Ronnie was just the kind of idiot who would do a thing like that just for the chance to stick his finger in the eye of society at large and to earn some bragging rights among his circle of like-minded idiots. He did have to give Ronnie credit, however—he knew all too well what it was like sifting through reams of code looking for tiny important details. It couldn’t have been easy finding that buffer overflow. He wondered how long Ronnie had spent at it. But his mission was accomplished so he finished his drink and made a quick escape after looking at his watch and mumbling something about it being late.

Chapter 14

Alan walked back up the street toward Jennifer's place, thinking about what Ronnie was up to. Was it really possible that he had found an attack that would allow him to take over the whole Grid. Alan wasn't sure what that would even mean. Clearly one couldn't take over the whole Grid forever. Ultimately the Grid Corporation ran all the nodes and could turn them off, wipe their memory, reinstall software, or whatever. But how much havoc could Ronnie create in the meantime? From Ronnie's little lecture, Alan had a sense of the kinds of ways Ronnie might be able to exploit the hole he had found. Most likely Ronnie would unleash some kind of worm—a program that uses the hole to get control of one node and then uses that node to infect other nodes with the same worm. That might be bad enough, even if the worm did nothing but copy itself around the grid it could bring things grinding to a halt. But if Ronnie really wanted to be a dick, he could unleash a worm with some other kind of payload, a program that would run on infected nodes after they had spread the worm around for while, doing something worse—corrupting data or interfering with the operation of the node beyond using resources to spread the copies of itself.

By the time he had arrived at Jennifer's address, he realized he was going to have to work with Jennifer and Greg to stop Ronnie. He considered telling Bryce about Ronnie but it would be hard to explain how he came to know about it. "Well, I've been hanging out with a bunch of outlaw crackers and they're trying to stop *another* outlaw cracker who wants to totally fuck up the Grid." He rang the bell.

Jennifer answered the door with a towel wrapped around her neck, wearing loose fitting black pants, no shoes, and a white tank top and dripping with sweat. Alan tried once again to not think of bedfellows, strange or otherwise.

"Jeesh. You been running a marathon around your living room?"

"Nah, just doing some Tai Chi."

"Okay, I've got to see this Tai Chi, you keep talking about. None of the Tai Chi I've ever seen before has looked like anything that was going to win a bar fight or work up any more of a sweat than maybe a moist upper lip."

"You know, you're really an colossal ignoramus. Fine, I'll show you. Then we talk about Ronnie." Jennifer threw her towel at Alan and walked to the center of her living room, which was large and bare except for a few cushions on the floor, all pushed to the sides of the room now. She stood facing slightly away from him with her hands at he sides and then gave a deep bow. Standing up she raised and lowered her hands, bending her knees as she did until she was standing with her thighs almost parallel to the floor. Then then proceeded through a series of movements, each flowing directly into the next. Though she was moving slowly he could almost see a series of imaginary opponents that she was dispatching with one move after another. And he could see how she was working up a sweat as she moved from her initial low stance up into one legged kicking postures and down to postures where she squatted down on one leg until she was almost sitting on her back heel. After a few minutes her movements brought her back to her initial position where she closed her arms in front of her before lowering them to her sides and bowed once more with her eyes straight ahead before turning toward Alan.

The way she looked reminded Alan of how she had looked in the clearing of the forest. To cover up his confusion he said, "That was beautiful, really. But I still

don't see how that translates into a bar fight."

She walked up and stood directly in front of him. "Push me." He reached out to push her on the shoulder but just as he started to push he felt her reach across with her other hand and grab his arm and give it a gentle tug that somehow sent him tumbling almost as badly as Ronnie had in the drinking club.

"Hang on there, I just lost my balance. That doesn't count."

"Okay, try again." This time he pushed her with both hands, a little harder because he was annoyed. Somehow she hardly moved at all, just stood there smiling at him.

"Come on, give me a real push!" she said.

Alan started really bearing down but Jennifer still didn't move, just standing and smiling until, after he had been pushing fruitlessly for about a quarter of a minute, she sort of dipped her body down, no more than an inch, and came back up, which somehow had the effect of popping Alan off away from her as if *she* had pushed *him* although she hadn't touched him with her hands.

"How did you do that?"

"Your body is not connected. You're pushing with your arms which are stronger than my arms but weaker than my whole body. *I'm* pushing with my whole body. Just the way Tai Chi has taught me. That's how Tai Chi translates into a bar fight. Now, tell me what Ronnie is up to."

Jennifer grabbed some of the cushions that had been pushed to the sides of the room and threw them on the floor. She sat down on one and Alan followed suit and told her about his conversation with Ronnie while she mopped her face with her towel.

"Hmmmm, the inter-node communication protocol code. I don't think we've found that one. I guess Ronnie's not as dumb as we'd like to think," said Jennifer when he was done. "Did he tell you what he's planning to do with that hole?"

"Nope."

"You have any ideas?"

"Who me? You're the expert cracker; what would you do with it?" Alan didn't want to share his idea about a computer worm; suddenly he didn't want to seem like an idiot to Jennifer if he could help it.

"Well, I would do something useful. But we've got to keep in mind that Ronnie is an idiot—he's just a monkey-wrencher so he'll want to do whatever would be the most noticeable and annoying to the most possible people. It's a shame really—if he's found what he says he's found it's a sweet opportunity. Which he's going to ruin for all of us with some stupid prank which will bring it to the attention of the jerk offs who run the Grid. Er, I mean your esteemed co-workers. Sorry, no offense intended."

"So," said Alan, "if they're going to find out about it anyway, I should just tell them and be done with it and save them and the rest of the world the hassle of dealing with cleaning up whatever mess Ronnie is planning, right?"

Jennifer didn't answer immediately but looked she was turning something over in her head for a few moments. "What are you going to tell them, that there's a exploitable bug in their inter-node communication protocol code but you can't tell them exactly where because you just heard about it from some guy in a bar? They're going to think you're trying to extort them. You came out tonight because you were worried about me getting in trouble—which was sweet of you by the way," she said, giving him a smile that made him think she really did think it was sweet, "but you'll be the one to end up in a small room with bright lights in your face and a guy trying to get the details out of you with a rubber hose."

Alan didn't *think* it would come to that. But he had already realized the difficulties of trying to explain what little he knew to his friend Bryce, let alone someone higher up the chain. And he did shudder when he imagined the hassles he would go through trying to actually get them to take action. "You have a better idea?"

"Well, *we* could probably stop Ronnie. If we can find the buffer overflow ourselves we can probably get control of enough nodes to head off whatever he's planning."

"So what do you need me for?"

"Well, we have collected a fair bit of the Grid's system code but we don't have it all. If we don't have the their inter-node communication protocol code, we can't find the buffer overflow. You should be able to put your hands on a copy."

"Yeah, probably." Alan still wasn't crazy about the idea of getting involved with the Underground but he suspected that Jennifer was right about how hard it would be to convince his bosses, or bosses bosses, or whoever it was he would have to convince, to take Ronnie's threat seriously, with as few details about what Ronnie was up to as he had to offer. And the way Jennifer was smiling at him, it was hard to say no. Anyway, bringing home some source code wasn't much of a risk—he had done it lots of time before and as a senior optimizer he had pretty wide latitude to look at whatever parts of the system he wanted. "Okay, I'll do it. I'll get you the source code. But I'm not doing anything from inside—they could track me in an instant and I'd be dead meat."

"Gotcha. No problem."

So Jennifer and Alan made arrangements to meet at her dinner club, after work and he got up to leave. She walked him to the door and opened it for him. "Thanks, Alan," she said and gave him a peck on the cheek.

Chapter 15

Alan woke up the next morning, not hung over but with a slightly sour stomach, and wondering what on earth he had gotten himself into. Somehow between the slight buzz from the few drinks he had had while pumping Ronnie for information, and Jennifer's post-exercise glow, helping out the Underground had seemed like a lot better idea than it did now in the light of day. Then he remembered Jennifer's kiss on his cheek and it seemed like a small enough risk to take, even in the light of day.

When he got to work he first sat down with the results he had as a result of Jennifer's reviving his job and determined that, in fact, his planned optimization was legitimate. He pulled the necessary forms from his desk drawer and filled them in, noting the changes to be made to what lines of code, explaining why the new code should be more efficient than the old code, and explaining what steps he had taken to ensure that the optimization would not affect any other code. In this case, he had to include the results of his automated analysis along with an explanation of how his new analysis code worked. He made copies of everything to keep for his files and put the originals into an interdepartmental-mail envelope. Because he was a senior optimizer his proposal would be checked by two other senior optimizers, chosen at random. But this proposal would probably take even longer to be evaluated because of the novel analysis code, which would have to be checked by the coding staff, who were ultimately responsible for new code.

Alan had once thought of trying for a coder position—they were usually considered the elite of the programming staff. The coders themselves tended to consider themselves to be the only real programmers—optimizers and debuggers were glorified clerks as far as they were concerned. But ultimately Alan had decided that coding wasn't for him. There was so little demand for new code and what demand there was, was usually for very minor modifications to existing programs. And the coders always preferred to solve problems by gluing together existing bits of working code with as little new code as possible. Strangely enough, Alan felt like finding optimizations in the reams of existing code required more creativity than the coders work. So he stuck where he was, occasionally finding a way to creating his opportunities to write new code, like on this most recent project.

He dropped the envelope in his outbox and looked through the printouts in his inbox. Technically you were supposed to work on things in the order they came in but as a senior optimizer he had a certain latitude to choose which things to work on when. Today he was looking, not as he usually did, for something that seemed like an interesting challenge, but for something that was close enough to the inter-node communication protocol code that he would be justified in getting a copy of that code from the code library. After a few minutes of searching he found a likely looking candidate and started reading the printout.

He quickly became so absorbed in the printout that it was another hour before he remembered that he wasn't supposed to be actually looking for optimizations, just a plausible reason to explain why he wanted to look at the inter-node communications code, in case anyone asked. A few more minutes and he had a good enough excuse to put off any casual inquiries. He put on his jacket as the library was in another building.

Entering the library he saw that his favorite librarian, Esma, was on duty. She was a bit older than Alan but dressed like a woman quite a bit younger, usually in

short skirts and tight tops that showed off her still quite attractive body. She was a terrible flirt and especially enjoyed teasing Alan because he was so bad at flirting back. She certainly wouldn't give him any trouble about whatever code he wanted so his carefully crafted excuse was totally superfluous.

"Why hello, Alan," she said with a mischievous grin. "Haven't seen you in a while. I've missed you. Found a girlfriend? If so I'll need to scratch her eyes out—I found you first."

"Uh, no, just finished up a month-long project. Now I'm finally getting to sink my teeth into something new." Alan went to the microfiche machines that held the code catalog and quickly found the catalog number of the listings he needed and wrote them on a slip of paper. "Here's what I need now, Esma."

"This isn't what you need, honey. I've got what you need. Only you won't admit it. But I'll get you your listings so you can run back to our office and hide from me."

"Thanks, Esma." Alan waited while Esma climbed up and down the rolling ladder attached to the bookcases holding reams of microfiche which contained the source code to the Grid. The code was read much more often than it was changed, and every change had to go through such a long approval process that it wasn't that hard for the library to keep an up-to-date copy and it saved valuable computing cycles compared to the old days when programmers would have looked at the code online. Once she found the files Alan had requested, taking maximum opportunity to give Alan a good look at her very nice looking legs, Esma brought the films to a microfiche printer and ran off a copy for Alan, logged them out, and had him sign.

"Come again soon," she said with a wink, blowing Alan a kiss.

Back in his office Alan looked over the code, just to get a feel for it. Luckily it wasn't a tremendous amount of code, less than a hundred pages. They were probably going to have to scour through every line of it to find the bug Ronnie had found. He stuck the code in a folder along with the ostensibly related listings that he was supposed to be optimizing. Senior staff were allowed to take listings home if they liked though it was not particularly common for them to actually do so.

To kill time until it was time to go to Jennifer's club, he reviewed junior optimizers' optimizations.

Chapter 16

Entering the eating club, Alan was a bit disappointed, but in retrospect not that surprised, to see that Jennifer was not alone. One of her table mates was Greg and the other was the man with the glass eye who had told him where to find Jennifer the night before.

As he walked up Alan started to pull the folder out of his bag to give to Jennifer. "Not here," she said softly. "Get something to eat and sit down with us. We'll go somewhere else to look at the code."

At least, Alan thought, he was going to get to eat. He went to the line, got his food, and brought it back to the table.

"You know Greg. And I gather you've met Mr. Green. He's the one who taught both me and Greg to program."

Mr. Green nodded at Alan and held out his hand. "Jennifer seems to think very highly of your abilities. And I think very highly of *her* abilities. However, I don't know yet what to think of her judgment. I hope you lead me to think highly of it as well. Sit down."

Alan shook his hand and sat down. They ate in silence. Alan got the sense that the other three had been talking about him and now that he was here they didn't know where to pick up. They were mostly done eating and he hurried to finish too. As soon as they were done, Mr. Green stood up and said, "We can go to my place—no one will disturb us there."

He lead them out of the eating club and to an apartment building with a doorman and a marble floored lobby. The elevator, of course, was no longer used, but if it had been it seemed likely it would have had an elevator man just to push the buttons.

Mr. Green led them up the stairs to the top floor where he had the penthouse suite. "Having the penthouse was a bit more of luxury when there was power for the elevator," he observed as they huffed and puffed up ten flights of stairs. When they reached the top of the stairs he unlocked the door and lead them in. "Let's go into the library."

Jennifer and Greg seemed quite at home and led the way into what turned out to be the library, which looked like any well-to-do man's library: floor-to-ceiling bookshelves with a rolling ladder. (Alan thought suddenly of Esma on the ladder in the code library, showing off her legs. Then he glanced over at Jennifer but she was wearing the same billowy pants as the previous night.) Several leather easy chairs and a matching sofa and a large wooden desk. However unlike the desks in most well-to-do men's libraries, the wooden desk in this library had something that looked quite a bit like a Grid terminal on it.

"Is that a Grid terminal?" asked Alan is disbelief.

"No," answered Mr. Green, looking up with a small smile. "It's a computer."

If Alan had disbelieved his eyes when he thought it was a Grid terminal, he had no frame of reference for the idea that it was a computer. "What does that even mean, 'It's a computer'?"

"It's what they used to call a 'personal computer.' It's an antique, of course, a quad-core processor, last made fifty years ago, just before Moore's crash. It was top of the line at the time, and thanks to the crash, if you could still buy a personal computer it would probably be about as powerful as this one. In Grid terms it's hard

to say what it corresponds to. It's probably a bit less powerful than a single physical node in the Grid but of course the Grid is made up of hundreds of thousands of nodes."

"Does it work?"

"Indeed. I don't run it often because I still have to pay for power. But on sunny days I can run it as much as I want—I also have some antique solar panels hidden on the roof that make enough power to run it."

"But why?"

"I like computers. When I was a boy, I had a computer like this and I thought it was the best toy ever. At first I just used it to play games. You wouldn't know what video games are, but they were great fun. And it could play chess better than any human on the planet. Go it wasn't quite as good at, but it was certainly good enough to beat me.

"Later I learned how to program it and then it was even more fun. Whatever I dreamed, I felt like I could make the computer do it. I thought I was going to be a programmer when I grew up. I was in high-school when Moore's Crash hit though it took a few years for the implications of that to start to be apparent. By the time I was in college between that and the energy crisis, access to computers was being cut way back. The University shut down its computer labs because it was cheaper to just rent time on the Grid. But soon the prices of the Grid started going up and soon undergraduates like myself couldn't get any time on the machine. We could still study programming but it was all pen and paper work.

"That was no fun. So I got out; switched to pre-law and then went to law school. Soon the grad students couldn't get Grid time. And then only professors who had the backing of big industry could afford it any more. At that point there was no point in having computer science departments in the university so industry brought the few researchers they needed in house; it was cheaper to put them on salary than to keep giving them grants that were supposed to support a superfluity of grad students.

"But I never lost my love for programming. And over time I came to realize that more than a few computer science departments were lost when computing become the exclusive province of a few big companies. By that time all of science had become dependent on computation and any chance we had of avoiding the destruction of the planet, at least as far as it's ability to sustain human life was concerned, had come to depend on science and the free flow of information and ideas. All of which were virtually destroyed when computation moved exclusively onto the Grid and under the control of the big companies that were destroying our planet and monopolizing the flow of information.

"But enough about me. Let's take a look at that code and see if we can keep Ronnie from causing too much mischief."

Alan pulled the folder out of his bag and extracted the inter-node communications code listings and handed them to Mr. Green. Mr. Green flipped through them and divided them into four sections, handing one each to Jennifer, Greg, and Alan, keeping one for himself.

Jennifer threw herself into one of the easy chairs, draping her legs over one of the arms and resting her head on the other arm, holding the listings up in front of her face. Greg stretched out on the sofa and Mr. Green sat down at his desk, pushing the computer monitor to one corner, clearing the main area of the desk and spreading out his listings. Alan took the remaining easy chair, though sitting in a more traditional posture than Jennifer's easy sprawl.

“I’d offer you something to drink but I know this kind of work will not be helped by it. In fact, I think I can splurge on a little home cooking,” said Mr. Green, standing up from his desk once he had his listings spread before him. “I’ll make us a pot of coffee.”

He returned in about a quarter of an hour, placing mugs of coffee on the tables nearest each of the chairs and the sofa. “I’ve got a bottle of good brandy I’ll save for after we find the bug.”

For the next hour the library was silent except for the sound of coffee being sipped, pages being turned, and the ticking of the grandfather clock next to the door. Alan, of course, was used to poring over printouts of code, searching for things. Unfortunately looking for optimizations was different than looking for bugs. He understood what he was looking for but it was not something his mind had been trained to spot. So he had to think much more consciously about what he was looking at than he had to when optimizing. From time to time, he’d look up from his listing and watch the others. Jennifer sat sprawled across her chair holding her listings up with slender but well-muscled arms, bouncing her foot as though she were listening to some upbeat dance music. Greg was lounging on the sofa, with his chin tucked in his chest and the printouts held in his hands which rested on his belly, making the printouts look something like a spear that had impaled him. Alan could see his eyes darting back and forth as they scanned each line of code. Mr. Green sat upright at his desk with his arms crossed on the desk in front of him. As he moved through the code he kept four pages at a time spread out in front of him and he occasionally flipped back through the pages in his hand to check something. Periodically he would pick up a pen and make a note on a yellow legal pad.

“Man!” said Jennifer finally breaking the silence. “Ronnie must be smarter, or at least more diligent than I gave him credit for. This is some dense code. Didn’t anyone ever teach the muppets who wrote this pile of crap about maintainability?”

“Ronnie’s problem was never that he lacked diligence or intelligence, as you well know Jennifer,” said Mr. Green. “At least not the kind of intelligence that would allow you to grok this ‘pile of crap’ as you so delicately put it. As to that, I’m sure Alan could explain to you why it is the way it is, at least in part. Alan?”

“Well, this code has clearly been worked over pretty well by some fairly good optimizers. If you know the kinds of things we do, you can almost see through to what the original code might have looked like. It was probably pretty clean code. In fact it had to have been—we can’t optimize things that are too much of a mess, it’s too risky. So even if it had actually been a pile of crap at one point we would have had to clean it up first, before we could do anything with it. As they always told us in training, ‘It’s harder to debug optimized code than to optimize debugged code.’”

“Whatever. It’s still a pile of crap now,” replied Jennifer, stretching like a cat in her chair before settling back into her code reading position.

“Okay, in another half hour if we haven’t found it, we all pass our code to the person to our left. No point going over and over the same territory. And it may be that the bug crosses one of the boundaries between the four sections of code I choose.

Another half hour passed as quietly as the first, Mr. Green got up and brought the coffee pot around to refill everyone’s cups and then said, “Okay, swap code,” handing his pages to Greg and taking Jennifer’s from her. Greg passed his to Alan who passed his to Jennifer and everyone resumed their previous positions.

Alan had just drained his coffee cup for the second time when he started to get what he thought of as his “itch.” When he was optimizing his itch told him that he was on the right track. It could still be hours or days or sometimes even work to

actually track down an optimization but once he started getting the itch he knew he was on the trail of something real. And he was starting to feel it now. There were a couple of routines that made him itch every time he looked at them. He flipped quickly through the pages in his hands, skimming the code and trusting his itch to tell him if there was any other code that he needed to consider. There was none. So he pulled out the two pages containing the suspect routines and compared them side by side. Still nothing in his conscious brain, but he was sure he was on the right track. Finally he realized he was missing a piece—two of the variables used in the routines he was looking at were set in the code he had handed to Jennifer. He got up from his chair and went over to Jennifer. "May I see that code again for a moment?"

"Sure, whatever. I need to stretch anyway."

He took the pages from her and she jumped out of her chair and standing on the rug, let her bare feet slide out to the sides until she was sitting in a complete split and began stretching her torso toward each leg in turn and then toward the rug in front of her.

Alan flipped through the pages until he found the places where the variables in question were initialized. Then he looked back at the two pages he had pulled from his own pile of code. "Uh, I think I've got something here."

Jennifer rolled over backwards and popped up to her feet. Mr. Green got up from behind his desk and Alan swung his feet down off the sofa to stand up. "What is it?" asked Mr. Green.

Alan showed them the two routines in his pile of printouts and then pointed to the code from the pages he had taken from Jennifer, spreading out the four pages on Mr. Green's desk. The stood around staring at the code. Alan didn't want to explain it—maybe he was wrong and would just sound like an idiot. But he couldn't be wrong—that code was buggy. Mr. Green looked at one page and then another until he had looked at all four and then did it again, finally saying, "I don't see it." Greg's eyes were darting furiously from page to page. Alan could tell he was irked that Alan had found it in the code Greg had already looked over and was desperate to find it quickly. Jennifer stood calmly in front of the desk looking at the pages and occasionally letting out a little, "Hmmmm." After a few moments, she stepped back from the desk put up her hand in front of Alan for a high five—"Nice work!"

Greg started and looking even more frantically between the four pages and mumbling under his breath. "Aha! There it is."

"All right, you're all geniuses, clearly. Now can one of you geniuses please explain it, slowly and in small words, to a tired old man?" said Mr. Green.

Greg was about to speak when Jennifer said, "You found it Alan. You explain it." So he did. It was not entirely surprising that this bug had lingered for so long in the code—it was the consequence of the interaction of four separate otherwise innocuous looking pieces of code. Mr. Green certainly wasn't dumb. A brief explanation from Alan was all it took to get him up to speed. Quickly he and Greg and Jennifer were discussing how Ronnie might exploit this bug and what if anything they could do to stop him. Greg guessed that Ronnie would write some kind of worm—something that would spread from node to node automatically, perhaps, as Alan had speculated earlier, with a malicious payload set to go off after a certain time. What to do about it was trickier. They could use the same bug as Ronnie to get arbitrary code running on whatever nodes they wanted but it wasn't clear, at least to Alan, what good that would do them.

"Do we know how Ronnie is going to get on the Grid?" asked Jennifer. Greg shrugged.

Mr. Green shook his head. “There are lots of folks who provide illicit access to their Grid terminals for a little extra cash. And maybe dozens desperate enough let Ronnie on. It’s hard to know which one he’s found though. Why?”

“Well, if we knew where he was getting on we might be able to cut him off at the pass. But if we can’t, we can’t. How long do you think we have before he launches his attack?”

Greg spoke up this time. “He was in the bar gloating last night, right. And he told Alan he had just found the bug. So he’s still got to actually write the code for his attack. Hopefully he’ll want to be careful enough to get it right and not squander his big chance. So a few days at the soonest. We know he’s a speedy coder, or can be.”

“Sure,” said Jennifer with a grin, “but we’re speedier.”

Mr. Green gave her a smile and pulled the monitor to his ancient computer back to the center of his desk and reached under the desk. A second later Alan heard the whirring of a fan and in a few moments text started appearing on the screen. Mr. Green then opened what looked like a drawer in the desk and pulled out a tray with a keyboard in it. “What’s the plan?”

Jennifer’s plan, it turned out, was to get there first and inoculate the Grid against Ronnie’s attack. What she knew, but Alan did not, was that on Mr. Green’s antique computer there was a piece of software that exactly emulated the hardware of a Grid node and running on that emulated computer was exactly the same software that the real nodes ran. If they could find the machine code in the Grid node operating system that corresponded to the bug Alan had identified, and which Ronnie was planning to use to attack the Grid nodes, they could devise a patch to fix the bug and then use the bug itself to propagate the patch to all the nodes in the Grid. Luckily Mr. Green and the rest of the Underground had spent a lot of time mapping out the machine code of the Grid nodes so they weren’t starting from scratch trying to find the machine instructions that were produced when the source code they had been looking at had been compiled. But it was still going to be another grueling slog, this time through thickets of machine code, the raw numeric codes that directly instructed the Grid computers what to do. Then, once they found the bug and figured out how to patch the Grid code, they’d also have to craft a worm to exploit the bug—the same problem Ronnie faced, though their payload would be the code to apply the patch rather than whatever more destructive thing Ronnie was planning. If they could launch their worm first and inoculate enough of the Grid before Ronnie could let his worm loose, they should be able to stop him.

Jennifer sat down in Mr. Green’s chair and her fingers started flying over the keyboard. Alan was impressed. He could type but only at the thirty words per minute required to pass the typing course that was inexplicably still included in both the optimizer and debugger training courses despite almost all of their work anymore being done with pen and paper. And she wasn’t just typing—windows were flashing open on the screen and disappearing faster than he could figure out what was happening. Greg had pulled up a chair and was sitting just behind her looking over her shoulder at the screen and occasionally making brief, cryptic comments that seemed to mean something to her as she often nodded and unleashed a new flurry of keystrokes and action on the screen.

Mr. Green, seeing how confused Alan looked came and stood next to him to give a play by play.

“They’re just trying to find the right basic area of the code for us to examine. Our map of the software is good but incomplete—it will help us rule out large chunks of code that we don’t need to look at. Then the rest we’ll have to sift through. But at least this time we have the advantage of being able to use a computer. We can’t

know exactly what instructions the source code you found will compile to but we can make some guesses and then use the computer to find bits of code that have the characteristics we're looking for.

Mr. Green and Alan watched Jennifer and Greg working away for another hour. Alan found himself feeling jealous of Greg both for his almost intimate position next to Jennifer—if you ignored the computer and her flying fingers it almost looked like he was whispering sweet nothings in her ear—and for his obvious deep understanding of the code they were looking at and the computer they were using. Alan realized with a start that the things Mr. Green had just described using the computer to do would be the equivalent of a job requiring tens or hundreds of times more cycles than the analysis he had run the other day. What kind of optimizations could he find if he had this much computing power at his disposal? "Who wrote the software they're using?" asked Alan, "That doesn't look like any software I've ever seen running on the Grid."

"I did," answered Mr. Green. "Or rather I and several thousand other programmers over time. Before the crash and even in the early days of the Grid, there were thriving ecosystems of what was then called "free" or "open source" software. Programmers wrote software and shared it with other programmers who could modify it to suit their needs or use it to learn how to do things. The operating system running on that machine was the product of thousands of hackers working over decades and sharing their work with each other. Likewise most of the tools. I built on some existing software to build the Grid node emulator and the software we use to maintain our map of the Grid code and do analysis of it."

"Okay, we've found a dozen bits of code that could be it," said Jennifer. "Let me print them out and we can decode them and see which one is the code we need to patch." She hit a key and from inside the desk Alan heard a tremendous clattering noise. Mr. Green pulled out a drawer and there sat a printer banging away whacking out code on fan fold paper being fed through the printer by two sprockets that hooked holes punched down either side of the paper.

"That thing is even more of an antique than the computer," explained Mr. Green. "However it's a lot less mechanically finicky than the printers that replaced it before the crash. This one I actually have a chance of fixing if the mechanical bits break. And when the ink ribbon wears out we can re-ink it which is more than you can say for the ink and toner cartridges of the more modern printers that obsoleted this one —those were designed to be disposable so you had to buy more."

After several minutes of clattering away the printer stopped and Jennifer ripped off the paper it had emitted. She then flipped through the printout and separated the printout into different sections and put them on the desk in four piles and then put on top of each pile the pages containing the source code of one of the four parts of the bug. "Okay, somewhere in each these piles should be the machine code for the corresponding part of the bug. Take your pick," she said, picking up one of the piles herself and flopping back into her easy chair.

The three men each grabbed a pile and resumed their positions, Mr. Green after turning off the computer and moving the screen back to the side of his desk.

This round of work was painful in its own way but easier in the sense of being more mechanical. Which was a good thing because it was getting quite late and Alan was feeling pretty sleepy. But he was well-experienced at reading machine code—many optimizations relied on looking at code at that level. He read through his pile of code and identified the machine code corresponding to the source code and stood up to stretch. Jennifer looked up at him from her chair, "Need a break?"

"What? No, I'm done."

“Whoa! Greg, check out the speed demon! Shit, I’m only halfway through my pile. Here you go Alan, back to work!” she said with a wink, tearing off and handing Alan half of the code she hadn’t looked at yet.

In another half hour they had all found the machine code they were looking for. Mr. Green looked up at the grandfather clock and said, “Okay, it’s practically morning now. No point going home now—there’s plenty of room here. We can plan our next steps over breakfast. Greg, you know where the blankets are; you can doss out here on the couch, since you like it so much. Jennifer, take the yellow guest room. And Alan, come with me, I’ll show you were you can get a few hours of sleep before breakfast.”

Mr. Green led Alan down the hall to a small but cozy guest room, with a soft bed and a puffy down duvet. “Get some sleep; you’ll need it.”

Chapter 17

Alan stripped off his pants, collapsed into the bed, and pulled up the covers. He'd need to call in sick in the morning, even if wasn't going to stay and help Jennifer and the rest figure out how to exploit the bug and inoculate the Grid. But somehow he knew he would be staying. With that last thought, he fell deeply asleep and didn't stir until a few hours later when a soft knocking on the door woke him and he opened his eyes to sun streaming through the windows. "Wake up sleepy head, time to get hacking," he heard Jennifer saying outside his door. He pulled his pants back on and opened the door. Jennifer was waiting outside in the hall, braiding her long hair into a single thick braid.

"Come on. Greg and Mr. Green are at breakfast already. We'll eat before we come back here to start strategizing. You can call your work from the eating club."

Alan followed her down the hall and out the door. Greg and Mr. Green were through eating and sitting drinking their coffee at a table away from the other late morning breakfasters by the time he and Jennifer got to the table with their food. Alan spooned oatmeal while the other three planned out the work ahead.

"We've got three tasks," said Mr. Green. "We've got to write a worm that can exploit the bug to spread itself around the Grid; we've got to write the payload code to patch the system; and we've got to get the worm into the Grid. I'm going to worry about the last bit—we want to be careful where we launch the worm from, if all goes well it's going to spread all over and the Grid masters are probably going to notice and want to track it down, even if it is benign. You hotshots figure out how to divvy up the coding parts and remember the sooner we get ours into the system the more likely we are to stop Ronnie. Also, when you write the worm, remember the Morris worm." He pushed back from the table and left the eating club.

"What's the Morris worm?" asked Alan.

"In the early days of the network, before the Grid," explained Greg, "a guy named Morris thought it would be funny to write a worm that spread all over the network. The worm didn't have any payload, it just copied itself around. Unfortunately the code in the worm that was supposed to keep it from spreading too quickly didn't work right and it infected the same machine over and over, and quickly brought thousands of hosts to their knees, majorly disrupting the net."

"Yeah, but we won't have that problem," said Jennifer. "Since we're going to patch the Node's system code, once one instance of the worm has done its job on a node, any others, coming from other nodes, will discover they can't get in anymore."

"Don't be so sure. We still need to figure out how to control the spread of the worm—even if they can't get in, if we end up with every node on the Grid trying to send the worm to every other node, even if none but the first one can get in, it could still cause a major disruption."

"Damn," said Jennifer, looking at Alan, "I hate when he's right. We'd better let him write the worm code then, since he's obviously way ahead of me anyway. And I'll need you and your God-like machine code chops to help me with the payload code. Let's go."

Back at Mr. Green's house, Jennifer let them in, and they all went back to Mr. Green's library. Jennifer turned on Mr. Green's computer and his fingers flew over the keyboard again, quickly producing two printouts of the machine code they had

identified the previous night. She handed one to Greg, saying, “You can use the computer; Alan and I are going to have to sit and stare at this stuff a bit before we’re ready to code.”

She took Alan to the kitchen and stared making a pot of coffee.

“You seem pretty at home here—how do you know Mr. Green?” asked Alan.

“He taught us to program, me and Greg. Or, anyway, he got us started—we sort of taught ourselves. But he’s on a mission to free the Grid from the greed heads I was ranting about the other day on our run. So he’s always looking out for kids with the right kind of minds to become programmers and tries to get them on the path. How about you, how did you get sucked into being an optimizer?”

“Oh, I don’t know. I wasn’t interested in anything in school but reading books. I went to college and read more books but when I got out I had no idea what I wanted to do. My parents got sick of me hanging around the house after I was supposed to be done with school and offered to pay for the optimizer training. At that point I was pretty desperate to get out of their house, too, so I went for it. Turned out I was pretty good at it. Now I like it, though what I really like is when I get to write a little bit of new code myself and that almost never happens.”

“Well, that’ll change today, I guess. Come on let’s get to work. You spread out those listings on the table and pour yourself some coffee; I’m going to take Greg a cup.”

Alan did as she said and then sat down with his coffee and wondered, yet again, how he had got dragged into this. Was it simply because he liked the way Jennifer looked at him when he did something smart and he knew that if he didn’t keep going she’d never talk to him again. Or did he actually buy this saving-the-world-from-greed-heads shtick? He didn’t have long to think about it before Jennifer came back.

They looked through the machine code they had found the night before and how they might patch it. Alan had never been a great one for talking shop with the other optimizers at work but, working with Jennifer, he was beginning to think that was because they were idiots. Talking with her about how the code worked and how they could change it was thrilling. Thrilling enough that he could go for minutes at a time without thinking of her as a beautiful girl. Which made it all the more disorienting when he’d break out his intellectual reverie and find his hormones going full blast. He felt like a teenager.

But soon, out of sheer self defense, the don’t-think-of-her-as-a-girl periods started stretching longer and longer as he tried to keep up with her ideas about what to do with the code.

Working with her was a new experience in several ways. First off, it was pretty much the first time he had ever worked with someone on the same problem—at Grid Corp his work was reviewed and he reviewed other optimizers’ work but the work itself as always done alone. Second, he wasn’t used to having someone who could understand his ideas about programming almost as quickly as he could get them out. They turned out to be a good team. Alan impressed Jennifer over and over again with the ease with which he read machine code and the number of details about how the code worked he was able to keep in mind at once. And she impressed him with her sheer creativity, as she spun off ideas about how they could do things almost faster than he could understand them.

Pretty soon they had a sketch of the changes they wanted to make to the Grid software and had worked out the sequence of changes their program would have to make in order to end up where they wanted without breaking anything along the way.

“Let’s go see how Greg is doing on the worm,” said Jennifer as Alan finished writing down the last details of their plan.

When they got back to the library Greg was sitting at Mr. Green’s desk staring at the computer screen.

“It works—I think,” he said when he saw them come in. “Assuming Mr. Green can find us a terminal with sufficient privileges to launch from, I think we should be good to go. Assuming, of course, we have a payload to launch.”

“We’ll have it, don’t worry,” replied Jennifer. “Go lie on your couch for a bit and let us use the computer. She sat down in the chair at the keyboard and her fingers started flying again. Alan took the seat looking over her shoulder, which he had so envied Greg having the previous evening. “Okay, remind me what our plan was,” she said to Alan, once they were in position.

Alan read from his notes and she typed away. He watched over her shoulder, occasionally catching small errors as she typed and reminding her of their plan when she lost the train of her thought. Quickly she entered the program they had sketched out in the kitchen. “Look good to you?” she asked Alan.

“Yeah. As far as I can tell.”

“Okay, let’s try it. Now I’ll load the node emulator and run our program in it.” Her fingers flew again and windows popped in and out of existence on the screen faster than Alan could keep track of what was going on. “There’s the node running. We can log in—good. Now run our program. Log out. We can log back in. At least it’s not broken in any obvious way. Okay, Greg, get your butt up and show us how to put our program into your worm.”

Greg took the chair from Jennifer, who stood up behind him watching the screen. Speaking in an esoteric shorthand Alan could barely understand, he asked her about their program and where it was and she answered and together they manipulated it into a form that it could be run as the payload of his worm.

“Alright,” said Greg. “So I’ll start up a few node emulators and then just to show we can exploit the bug, I’ll send in my worm with a payload that kills the node as soon as it has infected a few more nodes.” As he spoke more windows popped up on the screen. By now Alan could tell which three of them represented the emulated Grid nodes. They came up, and almost as quickly, winked out of existence. “So that works. Now I’ll start them back up and send the worm with the inoculant payload.” More typing and three more Grid node windows popped up. “Now I’ll try the killer worm again.” More typing and nothing happened. Greg and Jennifer both leaned in to peer at the text in the Grid node windows.

“It worked!” exclaimed Jennifer. “See,” she said, pointing at one of the lines in the window, “the node rejected the worm the second time because the hole was closed.” She held up a hand to Alan for a high five. “Nice work, partner.”

At that moment Mr. Green came back into the library. “I’ve found the terminal we’re going to use. Are you ready?”

“Just a moment,” said Greg. He pulled a thumb drive from a drawer in the desk and stuck it into the computer and typed some more. A moment later he removed the thumb drive and said, “Now we’re ready.”

Chapter 18

Mr. Green led them all out of his house and to one of the seedier parts of town. Alan had never been there and only knew it by its reputation which was bad. “Nice neighborhood, boss,” said Jennifer as the sidewalks over which they walked began to be littered with broken glass and half the buildings they walked past were boarded up and the other half seemed to be unauthorized drinking clubs with rough looking people and rougher yet looking bouncers hanging around outside.

“What’re you worried about?” he replied. “You’re a martial artist, right?”

“I can defend myself, if that’s what you mean. And I’d probably try to defend Alan here, as he’s more or less an innocent dragged into your schemes. But you two had better have your running shoes on.”

“Dragged in by you, if I recall correctly.”

“Never mind that. Where are we going?”

“To one of the folks crazy enough to let me use his terminal to launch a worm onto the Grid. He’s not one of our usual benefactors who loans us the use of their otherwise legit Grid terminal. He’s a true black marketer.”

Alan tried to imagine what that even meant. So far he had discovered that here are monkey-wrenchers like Ronnie who probe weaknesses in the grid just for the destructive fun of it. And Mr. Green’s Underground of genius hackers trying to free the Grid for the betterment of humanity. And now he learns there is a black market in access to the Grid. “But who on earth needs black market access to the Grid? Is it somehow cheaper than just buying access legitimately?”

“Oh no, it’s much more expensive. I won’t tell you how much I’m spending for tonight’s little adventure. But there are still folks who need to do something with a computer that they don’t want everyone to know about. Sometimes it’s a division within a big company doing something that might step outside the few laws we have left restricting the actions of those companies. Organized crime has its uses for computers. And sometimes parts of the government, especially those parts that got, in the last century, in the habit of operating outside the usual checks and balances, sometimes prefer the convenience of access provided by the black marketers to the hassles of getting everything properly budgeted and approved.”

As he finished speaking he turned into a narrow alleyway between what seemed to be two derelict buildings. About a hundred feet into the alley appeared a side door to one of the buildings. Mr. Green opened the door and ushered them in. Inside, the building appeared to be an old warehouse, that had been abandoned without emptying it. It was a maze of shelves and stacks of pallets. Looking at some of the labels on the boxes on the shelves, Alan could see that many of the boxes contained various kinds of obsolete electronic equipment.

Mr. Green led them through the virtual maze of shelves and pallets until he came to a small building within a building built out of scrap wood and corrugated tin. At the door to this building, Mr. Green stopped and knocked. They heard someone moving inside the building and then heard a voice from inside.

“Jesus Green, what’dya bring so goddamn many people for. You forget how to type?”

“This is my team. I told you I had a team. Let us in or I take my business elsewhere.”

Then they heard the sound of several deadbolts and other locks being released and the door swung open to reveal a wizened Filipino man, at least sixty years old and quite possibly anything up to ninety. He had long gray hair, in a braided ponytail that reached to the middle of his back, and a beard that had apparently been growing, without a trim, for as long as the ponytail. He was wearing cowboy boots with heels that added at least two inches to his height and at that he was lucky if he hit five foot six. He wore some kind of braces on his wrists over fingerless gloves of some thin material in an unattractive beige.

"Hello, José," said Mr. Green, when the door opened, "Glad to see you looking so well."

"Bite me. Show me the money." Mr. Green untucked his shirt to reveal a kind of wallet belted to his waste. He undid the buckle and pulled it out from under his shirt. He then unzipped the wallet and removed a thick wad of cash, handing it to José who stood and counted it while they waited."

"Good," he grunted. "That'll get you an hour. You need more than an hour, well that's too fucking bad—an hour is what you get."

"An hour will be sufficient, I'm sure."

José's building was like a smaller scale version of the warehouse that contained it. Where the warehouse was littered with boxes and pallets of obsolete electronics, José's house was littered with the same stuff but out of its boxes an in various states of disrepair or disassembly. Picking their way through the mess, they arrived at a room containing an extremely jury-rigged-looking Grid terminal.

"There. I don't know what you're up to and I don't want to know. I'll be in the other room until your hour is up. Which hour starts now."

As José was walking into the other room Greg was already plugging the thumb drive into the terminal and Jennifer was sitting down at the keyboard. If Alan had thought she had been typing speedily before, he had been sorely mistaken. Now her fingers were a blur, rat-tatting out instructions to the terminal to load their worm program and launch it at the node they were connected to. "Done," she said after a few seconds of furious typing.

"How do we know if it worked?" asked Alan.

"Well, if next time we see Ronnie, he looks happy, it didn't work," answered Jennifer.

"Any other way?"

"Nope. Greg, how long do you think it'll take for the worm to inoculate the whole Grid?"

"Hard to say," said Greg. "We don't know enough about the Grid topology to really say. I'd be surprised if it was less than a few hours or more than a few days."

They waited around for most of the rest of their hour. Greg periodically probed the nodes they could get to directly from the terminal to see if they had been inoculated. By the end of the hour, all the nodes he could find had been. They could only hope the worm was still spreading across the rest of the Grid. Satisfied there was little else they could do, they started packing up and Greg was just retrieving the thumb drive when José came barging back in to tell them their time was up.

"Pleasure doing business with you, José. As always." said Mr. Green with a small bow and then led the rest out of the room and back through the maze of the warehouse to the alley way. They walked in silence until they were back in a more reputable part of town.

They walked back to Mr. Green's house and he invited them in for a cup of coffee. Once they were seated around the kitchen table, cups in hand, Mr. Green pointed out that it'd be nice to know that Ronnie had in fact attempted his attack

and that their inoculation had prevented it from working.

"We know where he likes to drink," said Jennifer. "If we've blown it and his attack works he'll go there to celebrate and if we've foiled his evil plot, he'll probably be there to get drunk and bitch and moan to his toady Simon. That same drinking club where you talked to him, Alan. Why don't we meet there tomorrow night and see what his state of mind is."

"You know, I don't think he knows I'm in cahoots with you guys," pointed out Alan. "As far as he knows, I'm just a history buff with an interest in old-timey computing. Maybe I can get some more out of him in that persona."

"Great. So we'll meet there but not meet—you come in by yourself and if Ronnie is around, try to pump him some more. If we've foiled him, you can flash us a thumbs up. If it seems we've blown it, thumbs down."

"Good, see you then." Alan drained his coffee cup and stood up to leave.

Chapter 19

When Alan arrived at the drinking club the next night, Jennifer and Greg were already there, sitting together in a corner, as were Ronnie and Simon who were at the bar. Ronnie didn't seem noticeably gleeful, so that was perhaps a good sign. As he approach the bar he could see that Ronnie was quite a bit less than noticeably gleeful. He looked downright glum. Alan tried to remember what lies he had told Ronnie the other evening and to get into character.

"Hey, Ronnie—it's Ronnie, right? How you doing?" he said, as he sat down a few empty stools down from Ronnie and Simon and ordered a drink.

Ronnie looked up, obviously well into his night of drinking. "Whaddya want?"

"Just saying hello. I found our conversation the other evening fascinating. I had never realized how vulnerable the Grid was. Or were you just pulling my leg—you couldn't really take over the whole Grid, could you? Just through one bug?" Alan watched Ronnie carefully. It didn't seem likely that he'd be so morose if he had attacked the Grid and succeeded. But had he tried and failed or just not tried at all yet.

"Sure I could. I just need to find the right bug."

"I thought you had already."

"I did." Ronnie took a long pull on his drink. "But I must've had some old source code—the bug I found has been fixed and my attack didn't work. You know how long I worked to find that thing. Shit."

Alan turned to give a discrete thumbs up to Jennifer and Greg who raised their glasses to him. He turned back to the bar and sipped at his drink. The next thing he knew, Jennifer and Greg were coming over to the bar and sitting down next to Ronnie.

"Hey, Ronnie," said Jennifer. "How's it goin'. You look a little glum." She gave Alan a wink. "No hard feeling about the other night, eh?"

Ronnie looked up. "What are you doing here?"

"Just checking up on my old buddy Ronnie." That was laying it on a bit thick, even for Ronnie, even in his fairly inebriated state. He started looking at Jennifer and at Alan who was watching her taunting Ronnie. Alan may have given something away, not looking at her the way a stranger observing the scene would have.

"Wait a sec," said Ronnie angrily. "Do you know each other?" he asked, waving his hand in the general direction of Jennifer, Greg, and Alan.

"Who, Alan here?" asked Jennifer, putting her arm around his shoulders. "Oh yeah, we go way back. Don't we Alan?" Ronnie looked back and forth between Jennifer and Alan and Alan could see an idea forming in Ronnie's mind.

"You did it!" said Ronnie.

"Did what?" asked Jennifer with a campy feigned innocence.

"You did something to spoil my attack—I stupidly told your boyfriend here about it and he told you and you did something!"

"What could me have possibly done, Ronnie?" she replied.

"I don't know," spluttered Ronnie, starting to stand up, "But somehow you did it. You've always hated me and have always tried to make me look stupid. Well, I'm not stupid you know. Just because your precious Mr. Green liked you better and thought I wasn't good enough doesn't mean I'm stupid. I *found* that bug—I worked

for months to find that and you had no right to ruin it. I'm going to get back at you if it's the last thing I ever do." He threw some money down on the bar and stormed out of the bar with Simon trailing silently behind him.

"I'm not sure that was smart Jen," said Greg after Ronnie had left. "As he said, he's not actually stupid and if you piss him off enough he might think of some way to make life difficult for us."

"Oh, I just can't help it. He's such a doofus. What could he do, anyway?" She looked a bit ashamed as if, having done it, she realized there was no point in tormenting Ronnie.

Alan tended to agree with Greg. He didn't know the whole history between Jennifer and Ronnie but he could tell, just from what he had seen of them together, that there were only so many times that Ronnie could stand to be humiliated by Jennifer and Alan suspected that that number might already have been passed.

Chapter 20

Jack Jeseki had begun to despair of finding a route into the Underground. He had sent hundreds of employees into drinking clubs and eating clubs trying to find people who might be hackers or might know hackers or even who might know people who knew hackers. Unfortunately, most of his employees were Grid security specialists who, by and large, preferred poring over printouts, and devising new security audits, than in rubbing elbows and buying people drinks to get them loosened up. Mostly they just came back with receipts to be reimbursed for an evening of what he suspected was drinking alone, too afraid to talk to anyone.

In fact his only good lead at all had come from his secretary who had somehow come up with the names of several drinking clubs where, she assured him, several hacker types did their drinking. Thus it was that he was in the same drinking club with Alan, Jennifer, Greg, and Ronnie when Jennifer had finally pushed Ronnie over the edge. Despite Ronnie's yelling he had only heard snatches of the conversation over the noise of the club but he heard enough to catch the words "Grid" and "attack". And like Alan, he could see in Ronnie's face that he was a man who had been humiliated one too many times. When Ronnie stormed out he followed him hoping that he would go somewhere else to drink rather than heading home. Luck was on his side and Ronnie only walked a few blocks before coming to another drinking club, quite a bit seedier than the first, and going in. Jeseki followed him in.

Ronnie quickly sat down at the bar and ordered a shot of tequila, which he threw back before ordering another. Jeseki had also caught enough of the conversation to have gathered that Ronnie had revealed something to the man the woman had put her arm around that had lead to some bad result for Ronnie. So it was unlikely that any kind of subtle elicitation of information was going to work; Jeseki decided to go for an unsubtle approach. "Hello. I work for Grid Co. I was in the previous bar you were at this evening and happened to overhear a bit of your conversation with that young lady. If you could provide us some information about her, I could make it well worth your while."

Ronnie looked at him suspiciously. "I don't know nothing about the Grid."

"I understand that you might not want to trust me. And I gather that you yourself may have been engaged in some activities that you wouldn't want anyone from Grid Co knowing about. I assure you, that's not a problem if you can help me out. We're trying to track down some members of an organization we believe is called the Underground—dangerous computer hackers who steal from the Grid and disrupt its services. Just point me in the right direction and you will be well-compensated and no questions will be asked."

"How well?" asked Ronnie, looking bleary-eyed at Jeseki.

Jeseki took an envelope out from his inside pocket and opened it to show Ronnie that it was full of cash. "This can be yours if you come tomorrow to my office and tell me everything you know about that girl." He wrote the address on a piece of paper and put it on the bar next to Ronnie's drink.

Ronnie took a look at the envelope, threw back the rest of his drink, picked up the paper, and nodded. Jeseki, satisfied that he would see Ronnie the next day, put a bill on the bar saying, "Have another drink on me," and left the club.

Chapter 21

At home, after leaving Jennifer and Greg at the bar, Alan sat down to drink some rum and think about what on earth he was doing. He had told Jennifer that he didn't want to get involved with the Underground, but what had he spent the last two days doing but helping to pull off what might, for all he know, have been the biggest crack of the Grid to date, however benign its purpose.

And it had been satisfying in a way his work never was. Optimization was like solving a puzzle, which was fun in its own way. But this had felt creative, like writing a book or a piece of music. And that had hardly been the most interesting problem he could imagine. Yeah, it was important to stop Ronnie from messing up the whole Grid, but how much more satisfying would it have been to have been writing a program that actually *did* something? He didn't know if Jennifer was right that the Grid needed to be freed to save the world from destruction, but if it was freed and people started using it for something other than just running the same old simulations and models, there sure would be a lot more interesting programming in the world.

He was in the midst of these ruminations when there was a knock at his door. He opened it and was surprised to see Jennifer standing on the stoop. "You going to invite me in?" she asked.

"Uh, sure. Come in. Where's Greg?" he asked, peering out into the hall.

"Left him back at the club. He met some girl he liked the look of."

"Oh. You don't seem bothered by that. I sort of figured you guys were an item."

"We were once. But that was long ago, when we were kids, practically. Anyway, I notice I'm still not in."

Alan blushed and stepped back from the doorway to let her by. She was still wearing the outfit she had been wearing at the bar, a shimmery black dress that stopped several inches above her knees. When she took off her jacket and threw it on his couch, he saw that the dress hung from two thin shoulder straps and was cut deep in the back, almost down to the small of her back. The dress looked so silky and smooth that it seemed that if he were to simply put his hands on her shoulders, hook his thumbs under the straps, and slide the straps off her shoulders, that the dress would instantly fall in a puddle of silk at her feet.

She kicked off her shoes and padded around his living room looking at his bookshelves and the few photos of his family he had in small frames mixed in with the books. "You live alone?"

"Yeah."

"No girlfriend?"

"Not in a long time."

"Why not? You're cute enough."

"Dunno."

She saw his glass of rum on the table and picked it up and smelled it. "Rum. Smells nice. Can I have some?"

Alan went to the kitchen to pour her a glass and when he came back she was sitting on the couch with her legs tucked under her, holding his glass. "Here, trade you," he said, handing her the fresh glass.

"Here's to saving the Grid," she proposed, raising her glass with an ironic smile, before taking a big gulp.

“To saving the Grid,” he echoed, sitting down on the couch and taking a drink.

“To a great team!” she proposed next, taking another deep drink.

“To a great team,” he echoed again, taking another drink.

Suddenly she put down her drink and took his drink out of his hand put it down and pulled him to his feet, “Come here. I’m going to teach you some Tai Chi. In case Ronnie attacks you next time. Now you stand facing me with your left foot forward.”

He did as he was told and she put her left foot forward so that they were standing just about arm’s distance away. “Now shift your weight forward onto your front foot,” she said, matching her own actions to her word. Alan couldn’t help noticing, and enjoying, how the hem of her dress rode up a bit on her thigh as she did so. “Now put up your right arm like this,” she said, raising her arm in front of her with the back of her hand facing him. When he did so she pressed the back of her forearm against the back of his and put her other hand on his right elbow. He did the same. “This is called push hands. It’s a form of training that teaches you how to listen and respond to what another person’s body is doing without getting tense or struggling. We’ll start by simply circling. Push into me a bit with your right arm.” He pushed as she told him and she yielded back a slight bit and then turned her body to redirect his push and then circled it back around until she was pushing back into him. He tried to follow suit and after a few circles had got the hang of it. Her left hand rested lightly on his arm just above the elbow. It felt sort of like dancing. “This is just one simple pattern. There are lots more but you can also do it freestyle —always stay in contact and just try to flow, circling whichever way feels right.” And she started leading him around in different patterns. The skin of her arms was warm and he enjoyed the feeling of her hands sliding first from one arm and then another as she pushed him in different circles.

“Now,” she said, after a few more minutes, as they continued circling. “the real purpose of push hands is to learn to feel where your partner is open—where they are a little off-balance. When you feel that you can give a little push and see if you can make them move a foot. If you’ve really found an opening it doesn’t take hardly any pressure at all—just a gentle push and they go over. Like this.” And somehow, with no visible sign of exertion and no change in how hard she seemed to be pushing, she gave Alan’s a push that caused him to start tipping to the side, forcing him to take a step. When he reset his feet and they started circling again she said, “Now you try.”

They began circling again. Alan tried to push her as gently as she had pushed him but no matter which direction he pushed she was able to deflect it and circle back around. And he became more and more distracted by the feel of his hands on her arms and her hands on his arms and the occasional brush of one of her breasts against his arm, which she didn’t seem to notice but which he did every time.

“Sometimes the opening is not for a push,” she said, after he had been trying for a while, “But for a pull, like this.” And she slid her hand up to just above his elbow and gave a pull with no more force than it would take to pull open a well-greased door and suddenly he was stumbling forward into her. He tried to catch himself but he fell into her and she fell over backwards so they landed on the rug with him on top of her.

“I’m sorry—I must have tripped. You really didn’t pull me that hard,” he stammered, trying to get up. However she reached up with her arms and pulled his face to hers and kissed him gently on the mouth.

“The real purpose of push hands,” she said with a smile, “is to learn to feel where your partner is open—where they are a little off-balance.” Then she kissed him

again and this time Alan kissed her back.

Chapter 22

Loundobros fiddled with a pen on his desk, waiting for Jeseki to show up. He hoped Jeseki had some good news because he had a board meeting in a week and he needed something to tell them about the security situation or he wasn't going to be CEO for long.

When Jeseki was shown in, he hardly waited for him to sit before demanding, "Well?"

"Good news, boss. I found a guy who knows some people in the Underground and he's pissed about something. He's actually a bit of a loser—as far as I can tell at one point he thought he was going to be in the Underground but they decided not to take him. But they also seem to have done something recently to make him cranky so now he's willing to rat some of them out."

"Has he named names?"

"Yeah, apparently there's some girl named Jennifer who's supposed to be one of the top hackers in the Underground. She works with a guy named Greg, who our informant seemed to think was her boyfriend and another one named Alan though he didn't know much about him. He told us where we can probably find her and maybe the other two, a drinking club where she often hangs out.

"A girl, really? Well, it doesn't matter. Pick her up."

Alan had gone to work after his night with Jennifer but had not been able to concentrate at all, between his fatigue from having been up almost all night and his compulsion to watch the clock all day until it was time to leave and go meet her at her favorite drinking club.

When he arrived at the club he was pleased to see that, for once, Greg was nowhere to be seen, and she was sitting alone at a table. He joined her and she gave him a quick but in no way perfunctory kiss on the mouth.

"No sign of Ronnie tonight?" he asked out of curiosity, while taking hold of her hand that was unoccupied with her drink.

"Nope. Probably off licking his wounds somewhere. I really shouldn't be so mean to him. But I can't help pushing his buttons. A long time ago Mr. Green thought he had potential to be a member of the Underground. And he was a clever coder. He quickly sucked up everything Mr. Green had to teach him about coding and was assigned to me for advanced training. Which was unfortunate in two ways: First, Mr. Green soon realized that while Ronnie was a sharp enough coder, he was temperamentally unsuited to life in the Underground. He likes to show off too much and wants people to think he's a big shot. Neither of which are compatible with keeping a low profile, the way we need to. And he just didn't care about the things we care about—he just saw computers as a neat toy but didn't care one way or the other what they were being used for. The other way it was unfortunate was that while I was working with Ronnie, before Mr. Green figured out we needed to cut him loose, Ronnie became infatuated with me. At first it was just a bit uncomfortable, knowing that he spent as much time staring at my boobs when he thought I wasn't looking as he did paying attention to what I was trying to teach him."

"Well, you do have nice boobs—I doubt I would have done much better," Alan interjected.

"Yeah. Then it got a bit more tense—he asked me out and I said no. But I was still working with him because I didn't want to complain to Mr. Green about it. Then one night he were working at his place late at night and he started trying to touch me. Probably in his mind he was seducing me but it wasn't working and I kept pushing him away. Eventually he got frustrated enough to try a more forceful approach. I knew Tai Chi then too, though he didn't know it, though he was about to find out. Anyway, his forceful approach didn't work either but I think it was hard for him to maintain the illusion that I just wasn't in the mood or was playing hard to get when he ended up flat on his belly on the floor with his arm twisted up behind is back and me telling him I was going to break his wrist if he didn't leave me the fuck alone. I think the next day he went to Mr. Green to try and get a different teacher and that was the day Mr. Green kicked him out. So Ronnie blamed me for that too. Since then he's been constantly trying to show me what a hotshot hacker he is and generally being a pain in the ass—I suppose he thinks someday I'll regret rejecting him. Anyway, that's why I can't always be the fully-actualized human being I ought and just leave him alone."

"Well, I'd like to tell you that if he bothers you any more, I'll kick his ass, but you seem to have that department pretty well covered."

"Yeah. Anyway, I didn't come her to talk about Ronnie. I came to get you liquored up so I can take you back to my place and have my way with you again."

Alan was about to reply to that when three men walked up to their table and stood looking at Jennifer. One was a middle aged man who looked vaguely familiar to Alan and the other two were dressed in the uniforms of Grid Co's private security force. "Miss Jennifer Juarez?" asked the middle aged man.

"*Ms.*, but yeah, that's me." replied Jennifer.

"My name is Jack Jeseki, I'm the head of Grid Co security, and I'd like you to come with us; we have some questions for you."

Alan had heard rumors that Grid Co's security acted in many ways like the police force of a sovereign jurisdiction and tended to get away with it because the local governments and their police forces were highly dependent on Grid Co for running their own information systems. There were even rumors of a sub-basement below the sysadmin basement where he visited Bryce, where security had their own jail cells. Usually they dealt with protesters or the occasional lunatic why tried to physically attack a Grid data center. Suddenly seeing Jeseki, who he now recognized as someone whose picture he must have seen in some Grid Co corporate pictures, and his two thugs, the rumors suddenly seemed more real and more scary.

"Well, I don't think I want to go with you. I'm having a drink here with my friend," replied Jennifer, letting go of Alan's hand and freeing the leg she had hooked around his under the table.

"I'm afraid I'll have to insist. It's really quite urgent."

"Urgent for you maybe; I don't see where I come into it."

Jeseki took a step back and nodded at his two thugs who each took a step forward toward the table. Alan stood up, not thinking he'd really be able to do anything but trying to give Jennifer a little time. He wasn't sure her Tai Chi was going to work against two men, presumably trained in some sort of physical combat and each about twice her weight.

One of the thugs grunted at him to get out of the way but he stood his ground until the thug pushed him hard in the chest and he fell back into his chair. But Jennifer had used the moment well and had gotten up and clear from the table.

Unfortunately the thugs were still between her and the door so she couldn't make a run for it, so she stood waiting to see what they would do.

The thug who had shoved Alan took a step toward her and grabbed her by the wrist. Somehow she swung her arm around and suddenly the thug's arm was twisted up with his elbow pointed at the ceiling and she was bending his wrist at an unnatural angle as he crumpled to his knees grimacing in pain. The other security thug took the opportunity to step behind her and grab her from behind, pinning her arms to her sides. As he did so she jerked down on the first thug's wrist and Alan heard a crack and heard a quick scream from the thug. She then tried to stomp on the feet of the man behind her but she had kicked off her sandals when she stood up and her bare feet made no impact on his steel toed boots. Then the first man, enraged and dangling his broken wrist limply at his side, stood up and slammed his other fist into her stomach. With the wind knocked out of her she doubled over and the man behind her pulled her arms behind her back and quickly handcuffed her.

Alan stood up and was about to do something—he wasn't quite sure what—when the man handcuffing her pulled Jennifer back upright and looking right at Alan, Jennifer quickly checking that no one else was looking at her face, mouthed, "Find Mr. Green."

Jeseki led the two thugs out of the club, with the one who had cuffed Jennifer leading her before him and the one with the broken wrist bring up the rear after giving Alan a horrible glare.

Chapter 23

Alan rang the bell at Mr. Green's house repeatedly until the door opened. Mr. Green looked at him with a puzzled expression on his face. "What are you doing here my boy. I had it to understand that you and young Jennifer were out on a date tonight."

"They took her!"

"Who took her?"

"Some security thugs from Grid Co."

Mr. Green's lips tightened at that. "Damn! Come in," he said and led Alan into a living room he had not seen before where he was only slightly surprised to see Greg, sitting with a drink in his hand.

"Grid Co security took Jennifer in," said Mr. Green to Greg as they entered the room.

"Fuck. You were there?" he asked, turning to Alan.

"Yeah, they came to the drinking club."

"Who?"

"Jeseki—he said he's the head of security and I think I've seen him in some picture of the company executives. And he had two security thugs with him. Jennifer broke one of their wrists, I think."

Mr. Green smiled a small smile at that, "Yes, she would have, wouldn't she. I hope she doesn't pay too badly for that."

"What are they going to do with her?" asked Alan. From the time the thug had punched Jennifer in the belly to the time he had rung Mr. Green's bell, he hadn't stopped to think about what Grid Co would want from Jennifer and even now he didn't particularly want to think about what they might do to get it—all those rumors about Grid Co security and the sub-basement which had been shared in the office cafeteria with such grisly relish, now suddenly seemed horrifyingly real and terrifying.

"They want to find me, basically," answered Mr. Green. "They know we're breaking into the Grid and, the folks at the highest levels—the CEO and the board of directors—realize that we're a threat beyond simply stealing a few computing cycles. But they've never been able to get their hands on anyone who knows how we are organized, how we get in, and what we are really trying to do. They're usually much more successful at catching monkey-wrenchers like Ronnie—or actually usually ones dumber than Ronnie—who attack the Grid purely as a prank, usually using some piece of code they don't really understand to do something that, at worst, causes some extra work for the Grid sysadmins."

"Speaking of Ronnie, do you think he had anything to do with this?" asked Greg. "She tweaked him pretty hard the other night."

"Perhaps. He certainly knew enough to turn her in if he wanted to. But at this point, that's moot. We'll deal with him later. Our present problem is: how do we get Jennifer out before she's forced to reveal anything of any importance."

"Forced?" what are they going to do to her.

"You don't want to know. Especially since it's the people you work for," said Greg with a cold look on his face.

"Easy there, Greg," murmured Mr. Green. "If we didn't have Alan here, I don't think there'd be anything we could do for Jennifer. But with him, we may have a chance to spring her. I'm assuming of course," he said, turning to Alan, "That

you're willing to help us out to save Jennifer."

"Save her?! Is she really in danger?"

"You've really not been paying attention, have you?" asked Mr. Green, with a note of exasperation seeping into his voice. "Though I counseled against it, I know Jennifer tried to recruit you on your run in the woods. She explained to you, presumably, what we're trying to do and why it matters. If we succeed, almost all those powerful industries, and the rich and powerful people behind them, who are presently monopolizing the resources of the Grid to keep their grip on power will lose that grip. They're not going to sit idly by while that happens. They have convinced themselves that none of the signs of impending collapse of our society mean anything to them—that they can cocoon themselves in their mansions within their compounds within their gated communities and never face the facts about what they are doing to society and to the planet. From their point of view, we are the only threat to their position at the top of the food chain and with life on the lower ranks so miserable, thanks to the mess they've made of things, they're going to fight with everything they have to keep things they way they are. If they have to torture Jennifer to find us, they're not really going to care too much. Plus, they've no doubt arranged things so that the people who will benefit from the information they hope to get from her don't have to really know how the information was obtained. As with everything else they've done, they've no doubt set up a system which will inevitably result in some guy in a sub-basement working over Jennifer with a rubber hose, or worse, even though no one at the top ever explicitly authorized, or even envisioned, the use of rubber hoses or anything else."

Alan had to sit down. He had almost thrown up when Jennifer had been doubled over with the wind knocked out of her. Now Mr. Green was telling her she could be being tortured. Mr. Green brought him a glass of water and he gulped it down. "Okay. I'll help. Of course I'll help."

"Good. The first thing we need to do is find out where she's being held. We've heard from some of the monkey-wrenchers who've been taken in by Grid Co security that they were taken to the main building, where you work."

"There are rumors of a floor below the lowest floor people normally go to where Security has some kind of holding cells."

"Can you get us in the building?" asked Greg.

"Yeah. But I don't know how to get down to that sub-basement, if it even exists. The stairwells only go to the sysadmins basement and I can't even get in there without someone escorting me in."

"Well, let's get in the building first. Then we'll take it from there. And you have a Grid terminal in your office?"

"Yeah."

"Okay, let's go."

Chapter 24

Once the cuffs were on, Jennifer stopped struggling. She had lost that fight and she knew it, but there would probably be other fights, of one sort or another. No point wearing herself out now.

The two thugs walked her out of the club to a car waiting outside. People were standing around looking at it—cars being so rarely seen any more. Only on official business. So Jennifer guessed she was now official business. The middle-aged man who had introduced himself as Jeseki got in the front passenger seat and the thug with broken wrist got in the back on one side while the other moved her cuffed hands to her front and put her in the middle of the back seat, sitting on the other side of her. She turned to the broken-wristed thug: "Sorry about that wrist—your buddy here rushed me a bit." He grunted back at her, gave her a glare and then turned to look out the window, holding his broken wrist in his lap.

"So why, exactly, are you guys abducting me?" She was moderately terrified of what was going to happen to her but figured there was no upside in letting them know it. The man in front turned around to look at her.

"I think you know pretty well why. You've been up to some tricks that we'd like to know more about and we figured we take you back to our place and we might have an easier time, ah, *encouraging* you to tell us about them."

They arrived at the Grid Co offices and led her inside. Once inside, a new, equally large and menacing security thug replaced the one with a broken wrist who left, presumably to be taken to a hospital. Jennifer admired his toughness, having endured the whole car ride without so much as a moan. She was starting to wonder how much similar toughness she was about to be called upon to demonstrate. "Take her downstairs and put her in a cell. I'll be down in a bit," Jeseki said to the security thugs who led her to a stairwell, and took her down several flights of stairs. When the reached the bottom of the stairs, they unlocked the door with a key and led her through several halls to another door which they unlocked with a different key, revealing another flight of stairs leading still further down. At the bottom of those stairs, another key unlocked the door and they took her into a hallway lined with doors with small barred windows in them. They unlocked one of these and shoved her in, shutting and locking the door behind her.

The room was almost completely bare. A cot-sized slab, covered in white vinyl, protruded from the wall. In the corner was a toilet with no seat. The only window was the barred window, no bigger than a small book, in the door. In the ceiling was a compact fluorescent bulb, in a small cage to prevent it being broken or tampered with. The cage cast an annoying grid of shadows over the whole room.

Jennifer, still hand-cuffed, stood in the middle of the room and let her body relax. She checked her shoulder and found they were still a bit tight and let them drop. Then her elbows and chest. She let her tailbone point straight down at the floor and tried to feel the top of her head expanding upwards and her feet rooting into the floor. Then she closed her eyes and concentrated on her breathing, letting it sink into her belly. Occasionally her terror at her situation would try to break through her calm but she had stood meditating like this so many times that she was mostly able to let those thoughts go and turn her attention back to her breathing. She was still standing, paying attention to her breathing when she heard a key in the lock of her door.

Alan led Mr. Green and Greg through the city to the Grid Co offices. There was no rule against bringing guests into the offices, though it wasn't exactly common and he would have to sign them in. Luckily the security guards had long ago stopped bothering to check the IDs of visitors the way their regulations said they were supposed to. He got them into the building without incident and up the stairs to his office. "Now what?" he asked, collapsing into his chair as Mr. Green took his visitor chair and Greg perched on a filing cabinet.

"She's got to be in this building somewhere," replied Mr. Green. "You said something about a sub-basement."

"That's the rumor. The sysadmins are in the basement, to be near the machines. But there are rumors that there's a sub-basement below them that's controlled by Security. But the stairs down stop at the sysadmin's basement. And to get onto the sysadmins floor, you need to be escorted by someone with appropriate clearance."

"Do you know anyone who can get us on that floor?" asked Greg.

"Probably. My friend Bryce is a sysadmin. I go visit him sometimes. And he usually works late—he's probably here now. You want me to call him?"

"Can you trust him? If we tell him we're trying to find Jennifer, will he help us?"

"I think so."

"Call him. Don't mention us on the phone though."

Alan called Bryce who, luckily, was still working. He asked him if he could come up to look at something in Alan's office.

"Sure, I could use a break. See you in a few," said Bryce.

While they waited Mr. Green looked through some of the manuals on Alan's bookshelves. Suddenly Greg asked, "So, *did* you and Jennifer end up together last night? I got the impression she was going looking for you when she left the club."

Alan blushed and then felt like an idiot for blushing. "Uh, yeah. She found me."

"You have a good time?" asked Greg, with a tone that Alan couldn't quite decode.

"Sure," said Alan, in a tone that was aiming for noncommittal but not quite making it.

"Heh. I'll bet," said Greg with a chuckle. "She tell you she and I used to date?"

"Yeah, she mentioned it."

"Everyone thought they were a great couple," interjected Mr. Green, looking up from the manual he was reading. "Unfortunately for Greg, he could never figure out how to deal with a girlfriend who was smarter than him *and* who could kick his ass."

Greg snorted but dropped the subject, picking up a manual to look at.

A moment later there was a knock at the door and Bryce poked his head in. He looked startled to see the extra people in Alan's office.

Alan pulled him into the office and shut the door behind him. "These are some friends of mine, Greg and Mr. Green. This is Bryce." Then he got stuck, not knowing where to start.

"Let me try, Alan," said Mr. Green. "Bryce, you're here because Alan thinks he can trust you. I don't know if he's right but we have a very serious problem that we can only solve, it seems, with your help. So I'm going to hope he is."

Bryce looked totally nonplussed by this introduction.

"Bryce, have you heard of the Underground?"

Bryce nodded. "Sure. Folks trying to crack into the Grid all the time. But not to monkey-wrench it like a bunch of stupid kids. They're after something."

"Well, we're the Underground."

"You? And Alan?!" Bryce went from nonplussed to astounded and Mr. Green stood up and offered him his chair.

"Well, I don't know yet whether Alan is or not. But he is, at any rate, at least a temporary ally. But yes, Greg and I are. We are now at your mercy, obviously. If you were to leave this office and raise a hue and cry, Grid Co security would nab us and, with all due modesty, would be extremely pleased when they discovered who they'd nabbed. I wouldn't be surprised if they would give you some sort of reward. With that all said, will you listen to why we are here?"

Bryce had now moved from astonishment to slack-jawed amazement. "Shit, if only from curiosity. Go ahead."

"A colleague of ours," Mr. Green said, indicating himself and Greg, "and—if I'm not mistaken—your friend Alan's new girlfriend was abducted by Grid Co security tonight. They think she knows something about the Underground and they are quite right. In fact the only people who know as much or more about the Underground than she does, are Greg and myself."

"Jeesh. So why are you here? Can't you send someone else to rescue her without risking yourself? Just speaking tactically here."

"Well, a big part of the philosophy behind the Underground is that we feel something has been lost in our culture, a sense of human connection. Greg and I both have a strong human connection to our colleague—she's like a daughter to me and, as we were just discussing before you came in, she and Greg were once an item, though now they are just good friends. So it would betray much of what we stand for to look to our own safety while hers is in peril."

"That's cool, I guess. Crazy, but cool."

"I'm glad you approve. We don't have time for me to try to convince you of the rightness of our cause. But we have reason to believe that Jennifer, for that is the young lady's name, has been brought here and is now being held somewhere in this building, most probably in an area below the basement where you work. If we're right about that, then we're also, sadly, probably right to suspect that she is going to be very ill-treated by the Grid Co security staff in an attempt to get her to reveal information they desire about the Underground."

"You mean they're going to rough her up a bit?"

"I'm afraid it might extend a fair ways beyond 'roughing her up,' which I suspect she could stand up to with no real permanent damage done. Your employer, whether you realize it or not, while itself a monopoly, is largely under the control of a number of organizations, corporations mostly, who are *not* in nearly so secure a position. Their success depends on the Grid continuing to operate exactly the way it does now and consequently our activities in the Underground are a direct threat to their existence. And these organizations tend to play dirty. To put it quite bluntly, I'm afraid they will torture our friend with all of the fine techniques developed in the past century to break someone down and make them talk. She will not be able to withstand them but worse than that, even as powerful as our enemies are, they will find it easier to disappear her after they've tortured her than to have a living victim of their evil alive to tell tales."

"If you're right, that's fucked up. But what do you want from me?"

"We need to find a way to that sub-basement. Alan tells us that the normal stairs stop when they get to your floor. So there must be other stairs elsewhere, probably accessible from your floor, that go farther down. Can you get us onto your floor long enough for us to find those stairs?"

"Sure, come with me."

Jeseki entered her cell with a large guard who took up a station in the corner, watching her the whole time. The guard carried a chair which he put down for Jeseki to sit in.

"I'm sorry that we must have this conversation with a chaperon, but after you broke Billy's wrist, I'm not sure I'd feel safe alone with you," said Jeseki.

Jennifer watched him but said nothing.

"We've brought you here because we have reason to believe that you are a highly placed person in the organization known as the Underground. Let me assure you that you will tell us everything we want to know before you leave here. So really it is in your best interest to simply tell us what we want to know and walk out of here tonight. All the other ways we can do it will be much less pleasant for you, I am sure."

Jennifer stood staring silently at him.

After a minute had passed, Jeseki said, "This is your last chance to do this the simple way. No? Okay." He called out to someone outside the cell and the door opened and he walked out, followed by the guard, who picked up the chair and backed out of the cell, his eyes on Jennifer the whole time. However, the door did not close immediately. Instead, the guard came back into the room with a hose, and, as soon as he came in, the hose turned on and he soaked her down with freezing cold water. Her thin blouse went transparent under the soaking but it hardly mattered because once she was completely soaked, the guard backed out of the cell, the door shut, and the light went off. Then someone outside the cell slid a covering over the small window in the door, leaving Jennifer soaking wet, freezing, in total darkness.

Bryce took them down the stairs to the sysadmins' basement and unlocked the door to let them onto the floor. He waved at the guard, saying, "It's okay Joe, they're with me," and breezed on past. He took them to his office, led them in, and shut the door. "Okay, we're here, now what? Tunnel through the floor?"

"There's got to be a door somewhere that leads to the stairs," said Greg. "It's probably in some out-of-the-way place so people wouldn't see it all the time and wonder what it's a door to."

Bryce thought for a moment. "Okay, I've actually explored this floor pretty well. There's one door down the hall toward the server room that I've never seen anyone use and is always kept locked. Maybe that's it. But I don't see what that gets us; I've tried my keys—none of them open it." Bryce pulled out a wad of keys hanging from a retractable wire attached to his belt.

Greg smiled. "Let's go try that door. There are ways to open doors that don't involve keys."

Jennifer sat in the dark, shivering and trying to get a grip. She told herself that she had known she was in trouble as soon as they had handcuffed her, back at the club. She hadn't known then exactly what they were going to do to her and she still didn't. So no more reason to panic now, just because she was freezing and wet and in the dark. Unfortunately it was a lot harder to think those thoughts, or at least to believe them, when she was freezing, wet, and in the dark. No point huddling on the ground shivering. Shivering would warm you up a bit but not really do the job. She took off her blouse and wrung it out as well as she could. She thought about leaving

it off as it would just make her cold to have it on but then she realized she didn't know when the thugs would be back. No need to give them the satisfaction. Plus the shirt would dry faster on her body. Then she did the same with the rest of her clothes and put them all back on, damp as they were. With nothing else in particular to do, she began doing some Tai Chi drills that didn't require a lot of space. They soon warmed her up and her clothes were almost dry when the light came on and the door opened.

While her eyes adapted to the light she heard Jeseki's voice. "Ah, you've managed to dry off. Very enterprising. But to no avail. Guard, cuff her." And the guard came in and handcuffed her hands behind her back and then put cuffs on her ankles and then, pushing her onto the ground, pulled her feet up behind her and locked her handcuffs to the ankle cuffs so she was bent like a bow. Then he stepped away and someone else came into the cell and doused her once again with freezing water. However this time she was left lying in the puddles of cold water and couldn't get up to wring out her clothes. The guards left, the door shut, and the light went out again.

This time there was little she could do but shiver and flex her muscles, trying to warm herself. But she soon lost the energy for that and started to fall asleep. But then the door opened and someone came in and gave her another thorough soaking. Now there was enough water puddled on the floor that she didn't dare fall asleep for fear of drowning. Then for what seemed like forever, at random intervals, the door would open and she would be hosed down again. Her shoulders burned from the strain of her position until both her arms and legs started going numb. For lack of anything else to do, and trying to keep a grip on reality, she forced herself to count Mississippis between soakings and then compute the new running average and total time passed after each one. Her total elapsed time was twenty-three thousand nine hundred twenty-seven Mississippis or about six hours and forty minutes when the light went on and the door opened again but this time there was no soaking. Instead she heard Jeseki's voice.

"Come with me. Time to answer some questions." She was still blinking when two guards came in, undid her cuffs and, grabbing her by the arms, lifted her to her feet and half-carried, half-escorted her out of the cell. She tried to force herself to relax. Until she knew more about where she was, there was no point trying to fight off these two behemoths and she was in no condition to try anyway. They led her down a hall to a room only slightly larger than her cell. Typical interrogation room like every one she had ever seen in a movie or on TV. Table in the middle of the room. Chair for her. Chair for the interrogator. The guards pushed her down into her chair and then handcuffed her hands behind her, and then handcuffed the cuffs on her wrists to the chair itself. Then Jeseki sat down across from her.

"I always knew we'd catch up with one of you Underground types eventually and I'd be sitting here asking them questions. But I never figured I'd be enjoying the scenery so much," said Jeseki with a leer. "You're awfully cute for an elite computer hacker. I had always figured on a fat guy with a long beard and poor personal hygiene. But I shouldn't be surprised, your friend Ronnie told me what a looker you were."

Jennifer tried not to think of how transparent and clingy her blouse was and stared past Jeseki, over his shoulder. There was nothing in the room to look at but she didn't want to gratify him with a reaction. And she still didn't know what they really knew about her.

As if he had been reading her thoughts, Jeseki went on, "We know that you and your associates break into the Grid. We know you usually use black market

terminals so we can't trace you. And we know you are up to something more than just mindless vandalism. What we don't know is why. What are you trying to do? At first we thought you were working for some industrial concern that simply wanted to save some money by stealing cycles rather than paying for them. But we've analyzed your programs—what you're doing doesn't look like any kind of industrial computation. I'll tell you frankly, Miss Juarez, you're making my bosses nervous—they don't like things they don't understand and they don't understand what you're up to."

"Ms."

"What?"

"Ms. Juarez, not Miss."

"Call yourself what you want, Miss. The fact remains that we need to know what you and your friends are up to. And we need the names of your friends so we can have a little chat with them too. Or would you rather go spend a little more time in your cell?"

Jennifer tried to think. How much could Jeseki know already? Ronnie certainly knew she was part of the Underground. And Ronnie knew a bit about the goals of the Underground, at least at a philosophical level—he had learned that much before washing out. But he probably had wanted to downplay his own involvement with the Underground so he might not have told much of that to Jeseki. As far as she could tell Ronnie had just ratted her out, probably as his revenge on her for taunting him plus all the other times she had rejected him. Now that she had been taken in, Greg and Mr. Green would know to be on their guard. If they could figure out that it was Ronnie who had turned her in, which they probably would, they would know to avoid the places that Ronnie knew they went—he didn't know where they lived or really anything about them that would help Grid Co track them down. So all she had to do was hold on and not reveal what she knew about them, which certainly *was* enough to track them down. But hold on until what? She tried not to think about that. It was too early for despair; a little near hypothermia, a small amount of sleep deprivation, and being ogled by a creep in a suit should not be enough to make her give up all hope. Maybe they'd slip up and she could escape.

"Nah, I like it here. But I warn you, I'm a terrible conversationalist."

Jeseki reached across the table and slapped her hard across the face. "I'm NOT kidding around! You need to start talking or you're going to find out how very much I'm not kidding around. Now, name me some names."

Bryce led them to the door. He had checked the schedule for planned maintenance of the servers and there was none, so they hoped there would be nobody wandering the hall where the door was. When they got to the door, Bryce tried the knob but it was definitely locked. He quickly tried the dozen or so keys he had on his key ring but, as he expected, none of them worked.

"Okay," said Greg. "My turn. You guys keep watch." He pulled from his pocket a small leather roll, which he unrolled to reveal several oddly-shaped pieces of metal. He saw Alan looking at him quizzically. "I'm old school. Lots of the original hackers, way back when, also studied lock picking. And, it turns out, it's still a handy skill to have sometimes." He selected one of the pieces of metal and stuck it in the lock and used it to turn the lock slightly. Then he stuck a smaller piece of metal all the way into the lock and started stroking the inside of the lock. In a few seconds the lock turned and the door opened. He stuck his head through and said, "Yup, stairs going down." He tucked away his lock picks and rolled them back up

while Mr. Green and Alan started through the door.

Alan turned to Bryce, “You don’t need to come with us. You’ve helped enough. Go back to your office and pretend you never saw us.”

“Nah,” said Bryce. “I’ve think I’ve known for a long time there’s something evil about Grid Co. I want to see for myself how true that is.” And he stepped through the door. Greg came through last, checked that they’d be able to open the door from the inside and shut it again.

When they got to the bottom of the stairs there was another door. “What do we do if there’s someone on the other side of that door?” whispered Alan. Greg shrugged and looked at Mr. Green. Mr. Green shrugged.

“Bluff and bluster? And if that doesn’t work, Jennifer’s not the only one who knows a few fighting tricks.”

Bryce rolled his eyes. “You guys are a real bunch of professional terrorists, aren’t you? Fuck. Here, let me go through first. I can always claim the door at the top of the stairs was open and I was just seeing what’s was down here.” He put his hand on the knob and tried the door. Not locked. He opened it and walked through, closing it behind him. A second later it opened again and he poked his head around, saying, “Come on in. No one’s home.”

When they went through they were in the hallway where Jennifer’s cell was. They walked along trying to peer in the windows in the doors of the cells but all the cells were dark. Alan whispered Jennifer’s name into each window but received no reply.

“Hey, look at this,” said Greg pointing to wet footprints on the floor. “These can’t be that old.” The followed the footprints to the end of the hall and Greg peeked around the corner and quickly ducked his head back. “There’s a room up there with a light on and two guards standing outside. Now what?”

At that moment they heard Jennifer shout, “Get your hands off me you fucking creep.” And the sound of a slap. Before he knew what he was doing, Alan cried out, “Jennifer!” and went running around the corner. The guards turned toward him and he pulled up short. He didn’t think the little bit of Tai Chi Jennifer had taught him as a way of getting him in the sack was going to help much against these two, each of whom had several inches and at least eighty pounds on him. Suddenly Mr. Green went running past him barreling into the larger of the two guards who suddenly went flying over Mr. Green to land on his back, where Mr. Green swarmed over him and wrapped his arms around the guard’s neck. In literally seconds, before the other guard could gather himself, the man’s head lolled to the side.

Emboldened by Mr. Green and hoping Greg and Bryce might come to his aid, Alan charged the other guard, executing a much less graceful and entirely less efficacious tackle. In fact, the guard threw his legs back and dropped what felt like his whole weight on Alan, crushing him to the ground. Luckily Greg and Bryce had been close behind him and they pulled the guard off Alan and tried to pin him to the ground.

Mr. Green quickly moved to the second guard and grabbed his neck in the same hold as he had used to dispatch the first guard, saying, “Go hold that other guy down in case he wakes up.” The first guard was just regaining consciousness but was groggy enough that the three men were able to pin him to the ground and cover his mouth before he fully recovered himself.

Mr. Green’s guard was now unconscious and Mr. Green took the opportunity to pull off his shoulder bag and dig into it pulling out a roll of duct tape. He quickly tore off a piece of tape and taped over the guard’s mouth. Then he taped the guard’s wrists together with several wraps of tape and was just taping his ankles when the

guard started to regain consciousness. Then he moved to the first guard, was still struggling against the combined weight of the three other men and knocked him out again. Then he taped him as he had the other. “That tape won’t hold them for long, but hopefully long enough.”

Just as he was saying that, the door burst open and Jeseki came running out into the hall. “What the hell is going on out here?” he shouted, pulling up short when he saw the two guards on the ground and the four men standing around. Mr. Green stepped to him and, grabbing an arm, threw him to the ground. However, he held on to the arm, which bent at a funny angle, and Alan heard a snap and Jeseki cried out in pain. Mr. Green threw the roll of tape to Greg, saying, “Tape him up. Don’t worry about his arm. Whoever finds him will take care of it.”

Alan and Mr. Green went through the door together and saw Jennifer shivering in soaking wet clothes with a big red blotch on her face. Alan ran to her and discovered that her hands were cuffed to the chair. Mr. Green called for Greg to come with his lock picks and Greg soon had the handcuffs off. Alan put his jacket around Jennifer and led her out of the room. She walked over to Jeseki. “You’re lucky they taped your legs together or I’d kick you in the balls.” She satisfied herself with spitting an enormous glob of spit right in his face, which dripped down over the duct tape covering his mouth.

Chapter 25

"Okay, now how do we get out of here?" asked Greg. Mr. Green took back the roll of duct tape and wound a few more layers around each of the men's wrists and ankles.

"Let's see if we can get back to Bryce's office as a first step. Assuming no one finds these guys, it'll probably be an hour or two before they can get out. But if someone finds them, and we're still in the building, we're in deep yogurt. So let's get going."

Greg and Bryce started back toward the staircase. Alan helped Jennifer, who was still shivering, along and Mr. Green brought up the rear. At the top of the stairs, Bryce motioned for the others to wait while he checked the hallway. It was empty so he called for everyone to come out. Soon they were in the relative safety of his office with the door closed.

After a hurried discussion, they decided to simply brazen their way off the sysadmin level, hoping that the guards at the floor's exit wouldn't notice the addition of Jennifer to Bryce's party. Then she told them all to shut their eyes and stripped down to her underwear and wrung out her clothes as well as she could into Bryce's waste basket.

With her clothes back on, she put Alan's jacket back on and zipped it up to hide her still damp blouse. They walked out into the hall, with Jennifer on the side of the hall that would be farthest from the guard station. Walking as quickly as they could without looking suspicious, the passed the guard station. They all went through the door to the stairwell while Bryce went back to the guard station, saying, "Whoops! Forgot to sign you guys out; be right back." While he was signing them out, he said to the guard, "If anyone's looking for me, I just went upstairs for a bit; I'll be back in a bit." Then he entered the stairwell and ran up the stairs to catch up with the others.

Once in Alan's office, Mr. Green turned to Bryce and said, "I don't know if that guard noticed Jennifer or not. If he did, sooner or later they'll figure out you had something to do with her escape. If I were you I'd at least get out of this building; you can always come back if it seems that they didn't connect you with it. If you want, you can come with us. If they start looking for you, we may be able to help hide you better than you'll be able to do on your own."

"Well," said Bryce, "*This* is not how I expected to spend this evening. But you're probably right—I'll go with you for now."

"Okay. We'd better get out of here. Just to decrease the chance of them linking you and us, why don't we leave separately and meet outside." They then agreed on a place to meet, a park a few blocks away from the Grid Co headquarters. Bryce left Alan's office first but went to get a cup of coffee from the cafeteria while the others left the building.

They got out without incident and to the park to wait for Bryce. While they were waiting, Mr. Green lifted Jennifer's chin and looked into her eyes. "How are you, my dear?"

"I'm fine. Other than my severely frustrated desire to kick the crap out of Jeseki. Though I should be glad in a way, he couldn't decide whether he wanted to interrogate me or feel me up. What a fucking creep." She saw the worried look on all the men's faces. "Oh, he didn't do anything to me other than soak me with

freezing water and undress me with his eyes. Fuck him if I'm going to let that bother me. However I would very much like to get somewhere I can take a warm bath and sleep for about twenty-four hours."

"Alan, Greg," said Mr. Green, "Why don't you take Jennifer to my place. I'll stay here to meet Bryce and we'll meet you there."

Alan and Greg left the park and they all walked briskly to Mr. Green's house. By the time they arrived, Jennifer was feeling quite a bit better, though her sleepless night in the cell was starting to catch up with her. When they got in, Greg went to the library to sleep on the couch and Jennifer said to Alan, "I need a bath. Can you come sit in the bathroom and make sure I don't fall asleep and drown?" Once she was in the tub, she told him about her ordeal with Jeseki. After a half hour, she finally felt warmed up and she got out and Alan wrapped her in a towel and held her. "Okay," she said, leaning on him, "put me to bed now. I'm exhausted." Alan picked her up and carried her to the guest room where he had slept the night they had found the buffer overflow bug. He put her in bed and pulled all the blankets over her.

"Please, stay," she whispered. So he pulled off his clothes and slid under the covers with her and she took his hand and wrapped his arm around her, murmuring, "Thanks," and fell asleep.

In the morning they awoke to the smell of Mr. Green's good coffee. Jennifer rolled over on top of Alan and gave him a very thorough kiss. "Don't worry, Jeseki hasn't put me off all men, just creepy ones," she said with a smile, grinding against him.

When they finished, she noticed that someone, Mr. Green presumably, had put out some clean, dry clothes for her and she slipped into them while Alan put on his clothes and they both went downstairs. Mr. Green, Greg, and Bryce were all up already and drinking coffee. Greg looked up with a funny look on his face when they came in together, but Mr. Green smiled and asked how they slept.

"Great," answered Jennifer. "Now what do we do with all these unconvinced co-conspirators we seem to be picking up?" she asked, putting her arm around Alan's waist and gesturing toward Bryce.

"Bryce and I had a nice long chat last night. I'm not so sure it's fair to call him unconvinced," said Mr. Green. Bryce nodded at that.

"I always knew something was wrong with Grid Co. But I love my work—I just figured it was the price I paid to get to do what I wanted to do. But if you guys are right and we can free the Grid to actually be put to good use, to make the world better rather than worse, I'm with you. Plus I have to assume they're going to figure out I was involved in busting you out of their mini-Gitmo down there."

"And we have to assume that they're going to be coming after you, now that they know who you are and since you've seen their secret interrogation center and come out to tell the tale," said Mr. Green to Jennifer. "I think things are coming to a head now—it's a bit earlier than I would have liked but we need to crack the Grid open now and expose it for what it is."

"How?" asked Jennifer.

"Greg?" said Mr. Green.

Greg cleared his throat. "When we patched the system to keep out Ronnie's worm, I made a little addition to your program. We changed the system to close the hole Ronnie was going to exploit, but I put in a new hole—a backdoor that we could use."

“You what?!” exclaimed Alan. Although he figured he had no chance of extricating himself from the Underground, now that he was in love with one of their top hackers, he was shocked to discover that he had been an unwitting pawn in a massive crack of the whole Grid system.

Jennifer looked surprised too, and a little miffed, though her annoyance had more to do with not having been consulted. “Do you know your program works? You didn’t have a lot of time to change our code—what if you had botched it up?”

“Don’t worry. It works. I actually had most of the code written already, I just needed a way to get it running on a node. The patch worm provided a perfect way to get it running on *all* the nodes. Anyway, I ran some small-scale tests last night and we can get into any node of the Grid and do whatever we want. The question is what do we do? And can we do it before they catch on to what we’re up to and shut us down?”

Chapter 26

Jeseki and the two guards were finally discovered and released by the new shift of guards who came on duty in the morning, about the time everyone at Mr. Green's house was sitting down to coffee. Jeseki knew he had no choice but to go see Loundobros. He tried to clean himself up as best he could but couldn't get the residue from the duct tape off his wrists and ankles and even his face still felt sticky from the duct tape gag.

He was waiting outside Loundobros's office when the CEO arrived in the morning. Loundobros raised an eyebrow at his disheveled security officer. "What the hell happened to you?"

"Those Underground terrorists were here. We brought in the girl our informant tipped us off about. I was questioning her when a gang of them busted into the security level and beat up two guards and me and took her away. I've been tied up until about an hour ago."

"Where are they now?"

"Who knows. I ordered the building searched but, unsurprisingly, there's no sign of them. They're out there somewhere now," he finished, waving toward the city visible from the large window of the CEO's office.

"How bad is this?"

"Pretty bad. She saw enough to make trouble for us if she goes to the press."

"I don't want to know about what she saw. You've got to clean this up. The board meeting is next week and I do *not* need the press accusing us of running an illegal interrogation center. I don't care how you do it; in fact I don't want to know. But you need to clean this up."

Mr. Green took Alan and Bryce down into the basement and they brought up several large whiteboards which they set up in the library, turning it into a war room. Their strategic assets were, one, Jennifer's story of her time in the Grid Co dungeon, two, the back door into all of the Grid nodes planted by Greg, and three, the element of surprise regarding the latter. The element of surprise was going to be crucial—Grid Co still controlled the nodes and ought to be able to patch the hole Greg had created once they understood that it was there.

"We have two choices," started Mr. Green, "Quick or subtle. If we can launch an attack that damages them quickly enough, it doesn't matter that they can shut it down. Or maybe we can find a way to subvert the Grid so they don't notice it right away."

Bryce half raised his hand, "Uh, I know I'm new here, but what are you, or rather, we, actually trying to do? Shut down Grid Co? Get better management put in place? Destroy the Grid?"

"Ultimately," replied Mr. Green, "we want the Grid to be freely accessible to anyone, if not necessarily free of charge. 'Free as in freedom, not free as in beer' as they used to say."

"When was beer ever free, is what I want to know," mumbled Jennifer.

"But isn't that basically how it is now?" asked Bryce. "Sure it's expensive but you can buy time on the Grid if you've got the dough."

“Not really,” said Jennifer. “Cycles are auctioned off, but the more cycles you buy, the bigger the discount you get off the auction price. Long ago, perhaps, there was a reason for that—now it’s just a rule kept in place by the Grid Co directors who all have interests in the big corporations who buy the most cycles and thus like to get a deep discount.”

“And it’s worse than that, in reality,” said Mr. Green, “Because the Grid is entirely in the control of Grid Co, they ultimately have total control over who gets to use it. Ever notice how there’s never anything in the news about the Grid itself? That’s because all media, except word-of-mouth, is dependent on the Grid. And they never let anyone use the Grid to research anything that might affect the profits of the companies that control the Grid Co board of directors.

“But the real problem,” continued Mr. Green, is that they’ve locked up the whole intellectual heritage of the human race inside the Grid and nobody can get at it. There used to be things called libraries, massive collections of books. There were public libraries that anyone could use and vast research libraries attached to universities. Then in the days shortly before Moore’s Crash, people started digitizing these great libraries, scanning every book in existence into computerized form. The theory was that because everybody could access the books via the network, they would be available to more people. And that was true, at first. Then people got so used to having access to every book ever written instantly on the computer screen, people stopped conserving the books themselves. The great libraries closed, having become obsolete. The books were discarded. Not all at once, but over the course of decades. And no one noticed because everyone had access to everything and there was a flowering of human creativity.

“But with the crash, and the Grid coming under control of a few powerful organizations, all that knowledge disappeared into the Grid. The world is in a sorry state at the moment and the people who want to do something about it are crippled by having their heritage stolen from them.

“Have you ever heard of William Shakespeare?”

“No,” answered Alan, “who is he?”

“Only the greatest writer of the English language who ever lived; possibly one of the greatest playwrights in any language, ever. But his works are lost to all but a few scholars who have access to the Grid, and there are few scholars interested in things like plays who have the money for Grid access.

“The Underground has been clawing back that heritage bit by bit. Every time we crack into the system we manage to pull out another piece and share it. But at the rate we’ve been going, it will take centuries to free it all. And there’s always the danger that some of it will be lost forever—the people who run the Grid don’t care about much of the contents of their vast databases; they might at any moment press a button and discard forever the only copy of a great work of literature or a brilliant scientific insight. We’re quite certain that we’ve already lost large chunks of history in occasional bouts of outright censorship by the Grid authorities. We need to find a way to get more out at once.”

Bryce and Alan looked at each other. “Whoa!” said Bryce. “I was pretty happy to help you guys out just on the grounds that what they did to Jennifer here was so wrong. But this is bigger than I thought. What do you mean by get it out?”

“Well, we have a certain amount of storage—we scrounge old computer equipment and get it working. None of it is very reliable but we make lots of copies of things once we get them out. And for the most important things we actually print them and bind them into books. Again, we make multiple copies and distribute them around the organization. Many of the books in this library are just such books.”

“How much storage do you have? If we could free everything you want, can you hold it?”

“No. And producing printed books is incredibly laborious—we have to set type by hand. It was good technology in the 1400s and it still is good technology but it is not speedy.”

“So how are you going to free all that information, if you’ve got no where to put it?” asked Bryce, exasperated.

“Ultimately we need to free the whole Grid—if we can get our software running on enough nodes, we can force Grid Co to co-exist with us. They depend on the Grid too much to take the whole thing down. They can take nodes out of service and wipe them but if we can get on more nodes than they can take out at one time, then they can never uproot us.”

Suddenly, Alan perked up. “You’re talking about a worm, like what Ronnie was planning. But maybe what we really want is a virus—if we can infect some of the programs that the Grid uses all the time with some code that will run each time the program runs, propagating itself and doing something else we want, they’ll never be able to get rid of it.”

Mr. Green looked at Alan in blank amazement and then a huge grin crossed his face. “We had never thought of that because until now had no way to control a node at a low enough level. But I think you’re right—we can do it now.”

“Actually,” interjected Bryce, “We may be able to go one step further. What if Alan and I could get the virus installed into the master copy of some program? There are, as you might imagine, tight controls on changes to the master software, but we may have enough inside access to pull it off.”

Mr. Green stared at Bryce. Then he looked at Alan who was looking at Bryce. Greg and Jennifer were looking at Alan. “Could it work?” Mr. Green asked.

“You can’t install software by yourself, can you?” Alan asked Bryce.

“No way. We need multiple sign offs to make any change to the software that will get propagated to the rest of the Grid. But if the backdoor Greg put in to the inter-node communications code has spread to nodes within Grid Co, we may be able to use it to install a program that bypasses the normal checks.”

Alan thought for a moment. “But I don’t have access to the code that runs on the sysadmin nodes—they don’t care about optimizing it. Can you get at it?”

Bryce shook his head. “Not the source code. We never change it so there’s no point.”

“Well, I don’t see how we can hack that code to what we need if we don’t even have it!” exclaimed Alan.

“Wait,” said Jennifer, “I’ve seen you read machine code, Alan. We can do it in two steps—use the backdoor to get the binary version of the sysadmin code. Then once we figure out how to hack it, we can use the backdoor to install it.”

“I don’t know, that’s probably some pretty hairy code. This is going to be a lot harder to figure out than patching Ronnie’s bug. But maybe. But this only works if Bryce can go back to work—how do we know he isn’t going to be nabbed by Grid Co security next time he shows his face?”

Mr. Green looked at Bryce. “We think he’s probably okay. The only person who had a chance to see him with Jennifer was the guard on the sysadmin level and I don’t think he was paying that close attention. Bryce is willing to risk going back.” Bryce nodded again.

Jennifer, Greg, and Alan turned on Mr. Green's computer and Greg loaded the node simulation software and the code for his backdoor. Between the three of them they were able to quickly hack together a program that would first test for the presence of the backdoor and if it was present, to save a dump of the contents of memory. From there Bryce would merely need to transfer the file to another node they could reach from a black market terminal.

Mr. Green was meanwhile out trying to find José to line up the use of his terminal so they could plant the program for Bryce to pick up and then retrieve the dump.

"What, back so soon?" asked José when Mr. Green found him at the drinking club he favored. "You're a busy bee these days."

"Guess so." replied Mr. Green. "Can we get some time tomorrow? Mid-morning. Another hour should do the trick."

"Hmmmm. That's short notice. Have to charge you double."

Mr. Green nodded his acquiescence.

"That was too easy. I should have said triple," grunted José. "Oh well. Tomorrow then. Come at eleven."

Greg told Bryce the address of the node where they would leave the program and drilled him on how to run it. After several trial runs on the node simulator, Bryce could run it without hesitation. He then practiced uploading the dump to another simulated node. Once he could complete the whole process in less than a quarter of an hour, Greg declared him ready to go and showed him how they could send each other messages via the node once they were all connected, Bryce from the Grid Co offices and everyone else from the black market terminal. "Okay, everyone. Time to get some sleep." said Mr. Green. "Big day tomorrow."

Greg took his usual spot on the couch and as Mr. Green started to take Bryce to the guest room where Alan had slept before, Jennifer took Alan by the hand and led him away to the room where she had slept the first night they had all stayed over at Mr. Green's, which now seemed to Alan like something that happened a year before.

"By the way, thanks for coming to get me," she said, once they were in her room, wrapping her arms around him and giving him a kiss.

"Well, everybody did."

"Yeah, but Mr. Green told me about how you were the first one around the corner when you guys heard me yelling. Too bad I didn't have any time to really teach you how to fight. But it almost makes it sweeter that you were still willing to try to rescue me."

"Yeah, it's a little late for me to learn to fight I guess. But Mr. Green was pretty fierce. Where did he learn that stuff?"

"He told me once he was a Judo player; that sleeper hold is a standard Judo technique. But I also get the sense that there may have been more to it then that. I think when he was a much younger man he was part of a more militant underground group. I don't *think* he ever killed anyone but sometimes I'm not so sure. But enough about Mr. Green." Then she pulled off her clothes and got into bed. "You coming?"

"In a moment, I suspect," said Alan, with a grin, stripping off his own clothes.

Chapter 27

The next morning, over coffee in Mr. Green's kitchen, they agreed that Bryce would go to work at his usual time while Mr. Green would take Greg, Jennifer, and Alan back to José's warehouse to load the program up onto the node. If all went well the program should be uploaded by a few minutes after eleven and then Bryce could do his part. If Bryce ran into trouble with the code, they could communicate via the node. If he never connected to the node, they'd assume Grid Co security had been waiting for him and would try to find a way to spring him as they had Jennifer thought they had no real idea how they'd be able to do that without Bryce himself to get them onto the sysadmin level. Assuming that didn't happen, Bryce would meet them back at Mr. Green's house to help them analyze the code.

After they had finished their coffee, Bryce got up and shook hands with everyone, and then left, saying, "Hope I see you all again soon."

Mr. Green led the others back through the city to José's decrepit warehouse. This time José didn't make any cracks about the number of people but showed them into the terminal and stepped outside. Mr. Green also stepped outside to wait.

Greg connected to the agreed-upon node and used his backdoor to run the programs he needed to upload the code Bryce would need and to enable Bryce to communicate with them once he was connected. Then they waited for Bryce to connect. And waited. After ten minutes Mr. Green came in to see how things were going and Jennifer told him, with some worry in her voice, that there was no sign of Bryce.

Mr. Green gave a small grimace but said, "I'm sure he'll be there. I was watching that guard and he didn't notice you."

Another ten minutes passed and still no sign of Bryce. Then a window popped up on the terminal. "I'm in," read the message from Bryce.

"Good," typed Greg. "The program is ready."

"I see it. Downloading now."

A few moments passed while everyone watched the screen with bated breath. Then "Got it. Running," appeared. Then another thirty seconds passed that seemed like an eternity before Bryce message. "Done. Uploading." Greg opened another window to monitor the size of the uploaded file. When it had all arrived, he ran a checksum program and messaged Bryce to do the same. The checksums matched so the chance that the file had somehow been corrupted in transit was infinitesimally small.

"Got it. See you tonight." typed Greg.

"Right. Over and out," came back Bryce's reply.

Bryce disconnected from the node and closed the windows in which he had been running the dump program and messaging with Greg. Just as he closed the last window, he heard someone come into his office without knocking and turned around to see Jack Jeseki and two security guards.

"You thought, apparently, that no one recognized you last night?" said Jeseki. "You're going to be very, *very* sorry you decided to come to work today. Now get up slowly and come with us. And don't touch that keyboard."

Bryce stood up and one of the guards came toward him with a pair of handcuffs. He put out his wrists and the guard snapped them on one wrist and spun him around, cuffing his hands behind his back. The guards then frog-marched him out of his office and to the door which Bryce now knew led to the dungeon sub-basement.

The walked him down the stairs he had last been on less then twelve hours before and to the door that to the interrogation room from which they had rescued Jennifer. Jeseki motioned for the guards to put him inside and he found himself sitting in the same chair Jennifer had occupied the previous night. Jeseki came in after the guards and sat down facing Bryce. When the guards left he said with an ominous look on his face, "We were just getting started on your friend last night, in case you thought you were going to get away with just a little soaking with some cold water. And we're under some time pressure now, to resolve this little mess that you've helped to create. So we can, as they say in the movies, do this the easy way or the hard way. I strongly recommend you choose the easy way. Who were those people you were with last night?"

Bryce wondered if they had recognized Alan too. Assuming the others could decode the dump he had sent them and come up with a program that could infect the whole Grid with a virus, they still needed someone to run the program from a node inside the Grid Co network. Obviously Bryce was no longer going to be available to do it; Alan was the only one who could. Then there was his own situation. Mr. Green had been eloquent the previous night about the need to break Grid Co's grip on the Grid but Bryce wasn't sure that he was ready to stand up to torture for any cause. Anyway, the only thing that he knew that would be of any use to Jeseki were the details of the plan currently underway and Mr. Green's address. And Alan's identity. The rest, he could spill.

"The older man was Mr. Green. He's the head of the Underground. The two younger men were members of the Underground. I think one of them was the girl's boyfriend."

"And what were you doing with them. Are you part of this Underground?"

"Who me? No. I met the old man in a drinking club and once he figured out I worked here, he offered to pay me to get him and his friends down here. I guess your little dungeon isn't quite as secret as you might have thought."

"Never mind that. So you risked losing your job and probably getting arrested just for some money."

"Well, it was a *lot* of money."

"So what the hell are you doing back here today?"

"What can I say, I still like my work."

"You're full of shit. Looks like we're going to have to do this the hard way after all." Jeseki opened the door of the interrogation room and said something to the guards outside. Bryce heard one of the guard's footsteps going down the hall and then returning with someone else. A moment later a tall, thin man with lanky black hair entered the room pushing a small cart. He gave Bryce a malicious grin and picked up a small ball peen hammer off his cart.

The thin man then grabbed the back of Bryce's chair and, with surprising strength, pulled him away from the table. "Now, let's try again," said Jeseki, "why are you here today?"

"I told you, I like my work. I'm going to bank the money so I can enjoy my retirement a little bit more."

Jeseki nodded at the thin man who snapped the ball peen hammer down onto Bryce's right kneecap. The pain was excruciating, and Bryce let out a strangled scream. He tried to think of a different answer that wouldn't give away too much

but he couldn't really think of anything, let alone a more plausible lie. Then it hit him—he hadn't had a chance to delete Greg's program from his account. Presumably they would be examining his files while he was being interrogated. Once they analyzed the program they would know he had been trying to grab a dump of the sysadmin programs. It might take them a while but no real point in trying to hide that. Now he just had to milk it for as much as it was worth so he wouldn't have to give up anything else. Which meant he had to hold out a little bit longer so when he gave in they would feel like they had finally cracked him.

"I won't tell you." Another crack of the ball peen hammer, this time on his other kneecap. Bryce didn't have to fake being in agony but he kept his head just enough to decide he could stand three more of these before he started to talk. This time he just kept his mouth shut and shook his head. Another crack of the hammer. Another shake of his head and another crack of the hammer. Then one last shake and a final smash onto his right knee and he wondered if he'd be able to walk if he got out of this alive.

"Okay, okay. I'll tell you. They wanted me to run a program on my sysadmin account."

"What kind of program?"

"I don't know."

Jeseki gave another nod to the thin man who raised the hammer above Bryce's knee and looked into his eyes.

This was the moment of truth. Or rather of making the lie seem the truth. "I really don't know," mumbled Bryce not having to fake the pleading tone that he hoped would spare himself another excruciating jolt to his knee. It didn't and the hammer snapped down again.

"I don't know!" screamed Bryce, holding on to the idea that he didn't know so strongly that he almost didn't, especially as the agony in his knees made him unable to think about anything else.

Jeseki looked at the thin man who shrugged and lowered his hammer. The tiny part of Bryce's brain that was able to think about anything but pain gave a little cheer—they seemed to be buying it.

Jeseki went to the door of the interrogation room and said something else to the guards. "We'll soon see," he said when he came back, "whether what you say is true." The thin man, to Bryce's great relief returned his hammer to the cart. A respite, if perhaps only a temporary one.

A few minutes passed in silence and then there was a knock at the door. Jeseki went to the door and spoke briefly with someone there. When he returned to the room he sat back down in his chair and asked Bryce, "What were you supposed to do after you ran the program?"

"They just told me to connect to a certain Grid node. They were going to tell me what to do then."

"Give me the address of the node."

Bryce told him, hoping that the others had had time to get off the node and had been thorough about cleaning up any trace of their activities. Jeseki went to the door and this time it was the two guards who came back in. They pulled Bryce to his feet and he discovered that he could walk, though barely, and led him to the hall of cells and threw him into a cell, not even bothering to take off his handcuffs. Despite his best efforts he ended up smashing his knees on the hard floor when he fell down. After that, he curled into a fetal position and wondered whether the others would really be able to rescue him.

After downloading the dump from the node to José's terminal and copying it from there onto an antique thumb drive, Alan, Jennifer, Greg, and Mr. Green returned to Mr. Green's house and loaded the dump onto Mr. Green's ancient computer. With Alan and Jennifer watching over his shoulder, Greg loaded the dump into the node simulator and started running some analysis programs that would attempt to untangle the different programs that had been running when Bryce had captured the dump. "I've already done this with a dump I took of a vanilla node," he explained. "A lot of the programs running on the sysadmin node should be the same as on a normal node—hopefully we can match those up so we don't have to spend time looking at them. This is going to take a while though. We should go get some food."

Jeseki had to trudge the ten flights of stairs from the interrogation level up to Loundobros's executive suite on the top floor and was out of breath when he got there. He paused to catch his breath and to think about what to tell Loundobros. Clearly this was a serious security breach, to have a sysadmin turn traitor. Those people were supposed to be vetted, goddamn it. What wasn't clear was whether there were any actual consequences to the breach. His techs had found and analyzed the program Bryce had run and determined that it had dumped the state of the node's memory to a file. Presumably if Bryce had had a chance to communicate with his Underground conspirators, they would have had him upload the file so they could analyze it. But of what good could that possibly have been to them? Jeseki also considered the possibility that Bryce had managed to lie, even under the pain of the thin man—as even Jeseki thought of him—hammering his knees. Possibly he had in fact uploaded the file somewhere. But did he want to tell Loundobros that. Probably not. As far as he knew, using the best interrogation tactics he had available, there had been no real breach—why make trouble for himself by mentioning the possibility?

Having decided not to mention the possibility of the dump having been uploaded, and having caught his breath, Jeseki went into the anteroom to Loundobros's office. Loundobros's secretary asked him to take a seat and told him the CEO would see him presently.

Presently turned out to be about a quarter of an hour. Which ordinarily would have annoyed Jeseki but today was fine as it gave him more time to get his story straight. Bryce had been paid by the Underground to help them spring the girl and then paid to come back and run a program for them from a sysadmin node. He had been caught just after he ran the program, which had produced a dump of the program but it hadn't gotten anywhere so nothing of consequence had actually happened except the escape of the girl. He could promise Loundobros that he and the thin man would work Bryce over some more to make sure they had squeezed everything he knew about where the girl had been taken and by whom.

By the time Loundobros's secretary told him he could go in, he had his whole spiel ready to go and well-rehearsed in his mind. There was no chance that Loundobros could not believe that the situation was well under control.

After a pleasant meal at a eating club that none of them but Mr. Green had ever been to, and he not in decades, they returned to his house to get to work on analyzing the dumped code from Bryce's sysadmin account. They made sure to be back early enough that Bryce wouldn't end up waiting for them. Greg's analysis

code had run while they ate and had eliminated about eighty percent of the code as common between a sysadmin node and a plain vanilla public node. That sill left them quite a pile to sift through to find the code they would need to hack in order to bypass the normal change controls and infect one of the Grid master programs.

They tackled it the same way they had finding Ronnie's bug. Mr. Green printed out dumps of the code and divided them into four piles. This time they needed to get a quick sense of what each program did in order to find the one that would be used to install a change into one of the Grid master programs. Unfortunately, to understand what a program did, at a high level, from looking at its machine code was somewhat akin to trying to understand the behavior of a vast nation of people by examining the detailed diaries of all of its citizens.

As before Alan was the most adept at reading machine code. He could quickly skim a program and get a sense of what it was doing. Pretty soon they decided that it would be most efficient for him to skim all the code and divide it into three piles: unlikely, possibly, and very likely to be what they were looking for; and then for the others to concentrate on understanding the 'very likely' pile.

By the time he had finished dividing all the code into those three categories it was getting late enough that they expected Bryce to arrive any minute. When they realized another hour passed and there was still no sign of Bryce, they started to worry but tried to convince themselves that he had taken a long time eating dinner. Then another hour passed and that explanation became completely implausible.

"Could they have nabbed him after he uploaded the dump?" wondered Jennifer.

"Anything's possible," answered Mr. Green. "The immediate question is what does it mean for us? And, assuming we're still okay, what can we do for him? I'd hate to leave him in the clutches of Grid Co security and that Jeseki. He sounds like a piece of work, from what you told me."

"Well," said Jennifer, "He knows what we're planning to do. He knows there is a backdoor and knowing that they could probably find it the way we found Ronnie's bug once we knew it was there. If they close the backdoor, none of this works."

"True," replied Mr. Green. "But if it doesn't work, it doesn't work; there's nothing we can do about that. We still live to fight another day. I'm more worried about things that could lead them to us in the near term."

"He knew the address of the node where he uploaded the dump. But that doesn't matter anymore—we got the stuff off and wiped all traces of our activity," said Greg.

"And he knows the address of this house," pointed out Alan, "Or he did if he was paying attention."

"That's the one that's a problem," said Mr. Green. "Assuming they've got him, he must have managed to avoid revealing that information so far or Grid Co security would already have busted down our door and taken us too. But we can't assume just because he's held out this long that he can hold out indefinitely. Time for us to pack up and really go underground."

Mr. Green then directed Alan and Jennifer to pack up all the printouts and asked Greg to pack the computer for carrying. "There are few enough people who have computers we can use—it would be a pity to lose that one." Meanwhile Mr. Green pulled a large backpack out of a closet and had started loading it with books from his bookshelves. "It will be a pity if they do find this place; I can't take all the books that deserve it. I'm pretty sure none of the ones I'm leaving behind are only copies. At least I hope not—the state of our recovered heritage is so precarious."

"You have another backpack? I can probably lug some books," offered Alan.

“Me too,” added Jennifer. “Heck,” she said with a wink, “I can probably carry as many as you two old guys combined.”

Mr. Green left the room and soon returned with a two more backpacks. “Here, Jennifer, the big one is for you.” He started pulling more books off the bookshelves and Alan and Jennifer packed them into the backpacks while Greg dismantled Mr. Green’s computer and packed it into a backpack with foam compartments for the various pieces.

Once they had everything packed and Mr. Green started to lead them downstairs, Alan thought to ask where they were going. “We have some safe houses we can use,” said Mr. Green. “Mostly homes of people who are sympathetic to our cause but otherwise uninvolved. There’s a nice little old lady who lives not too many blocks from here who was a friend of mine. She was quite a talented web designer in her youth, back when that was a hip thing to be.”

Mr. Green told them the address and said, “We ought to split up. You and Jennifer go on ahead. Ask for Ms. Liu and tell her I sent you. She’ll let you in. Probably make you a nice cup of tea. Greg and I will be along a few minutes after you.”

Alan and Jennifer swung their backpacks on to their backs, and Alan noticed that even Jennifer staggered a bit under the weight of the books. Mr. Green led them to the front door and then went out himself to check that the coast was clear before letting them out. “See you in a bit,” he said. “If we don’t show up within an hour, leave the books with Ms. Liu and take the code printouts and find José. Tell him I’m in trouble and he’ll help you. Ignore his grumbling.”

“Okay. But we’ll see you,” replied Jennifer, and started down the street. It was, as Mr. Green had said, only a few blocks which was lucky, as those books were heavy. The address was in a large apartment building and unfortunately, Ms. Liu’s apartment was on the fourth floor.

Alan and Jennifer arrived at the top completely out of breath and rang the bell. A tiny and ancient Chinese woman answered. She looked well into her seventies but from what Mr. Green had said, they knew she was even older. She was very slightly stooped from age but her eyes were clear and bright and she didn’t look at all confused or worried to find two strangers wearing enormous heavy backpacks to be ringing her bell late in the evening. She looked at them quizzically.

“Mr. Green sent us.” gasped Jennifer.

“Ah,” she said, making a tiny bow. “Come in please.” She ushered them into the front hallway of her apartment which was filled with inexpensive slippers in various sizes. Jennifer kicked off her shoes and put on some slippers in her size. Alan followed suit. Then Ms. Liu led them into her living room where there was just barely room for them to shrug off their backpacks. She disappeared for a moment and returned with a pot of tea and several tiny tea cups. “Tea?”

Jennifer shoved the backpacks against a wall and out of the way a bit and, under Ms. Liu’s direction moved a low table to the center of the room. Ms. Liu sank gracefully onto a cushion on the floor. Jennifer followed suit. Alan looked around and realized there were no chairs but plenty of cushions. He lowered himself somewhat less gracefully to the floor.

“Those packs are full of Mr. Green’s books. He should be here soon,” explained Jennifer though Ms. Liu was calmly pouring tea, not looking as if any explanation was needed for the arrival of several strangers carrying a couple hundred pounds of books.

They sat sipping tea for a while. Ms. Liu and Jennifer both slurped theirs noisily. Alan inferred that that was in fact the polite way to drink tea out of the tiny cups they were using but couldn’t quite bring himself to follow suit. He kept looking at

his watch and expecting the doorbell to ring again any moment. After forty-five minutes Jennifer started to look a bit worried too. Ms. Liu had gone into the kitchen and brought out a new pot of tea and some small snacks.

Another ten minutes, and Alan and Jennifer had both lost all interest in the tea and snacks. The sat staring at the door, willing the doorbell to ring. Finally with just a minute to go before the hour was up the bell rang. Ms. Liu rose, as gracefully as she sat down and walked to the door. When she opened it she stepped back suddenly as Greg practically fell across the threshold. He was breathing harder than even coming up the four flight of stairs would account for and face was bloody. "They got Mr. Green," he gasped. "I had to abandon the computer too, hopefully they won't find it, at least not too soon."

Ms. Liu grabbed Greg under the arms and, with a strength that belied her somewhat fragile appearance, pulled him into the living room while Jennifer hastily moved the table out of the way. Alan took a quick peek out the door to see if anyone was coming up the steps and, seeing no one, shut the door and made sure the deadbolt was set.

"Did they follow you?" asked Jennifer as soon as Greg was laid out on the living room floor.

"No," he grunted. "They jumped us and we fought but once they got Mr. Green they didn't seem to care about me. There was no one around when I came here." Ms. Liu, who had disappeared into the kitchen, returned with a bowl of warm water and a clean towel and began gently wiping the blood from his face.

"And where is the computer?"

"I hid it in a dumpster on Cedar Street. The dumpster was mostly empty so I'm hoping it isn't due to be emptied very soon."

"Ms. Liu, can we leave him with you? We need to go get that computer."

"Of course. He'll be quite safe here."

She certainly seemed better qualified than them to take care of Greg. So Jennifer got a few more details from Greg about where the dumpster was and then ran to the front hall and replaced the slippers with her shoes. She looked at Alan who quickly did the same. Having finished cleaning Greg's wounds, Ms. Liu followed them to the hall. "Jennifer," she said, "I think Mr. Green spoke of you once. You study Tai Chi? Pretty advanced?"

"Well advanced enough, I guess." answered Jennifer, clearly surprised.

"Then maybe you know what to do with this?" suggested Ms. Liu, opening her front closet and pulling from its depths what looked to Alan like a bamboo flute, about three feet long, with a red tassel on the end.

"Yes, indeed."

"Maybe better, on a night like this, than only your hands," said Ms. Liu handing it to Jennifer with another little bow.

"Yes, thank you very much," replied Jennifer, bowing in return, and taking the flute. "Come on Alan. Let's go."

The ran down the stairs but when they got to the door to the street, Jennifer slipped her hand in the crook of Alan's arm. "Just a couple of young lovers out for a walk. No need to draw attention to ourselves."

"Why worry about that—I suppose you can tootle them to death if they bother us," said Alan, gesturing to the flute which Jennifer carried in her other hand.

"Alan, don't be such an idiot. What does this look like?" she asked holding it up.

"A bamboo flute," said Alan. "Oh, with a nice tassel."

"Okay, ignore the holes that make it a flute. Now what does it look like?"

"Uh, a bamboo stick."

“Yeah. Have you ever been hit upside the head with a stick? Let me assure you, it hurts. There’s an advanced Tai Chi form called the Flute Form which is practiced with a flute like this. But basically it’s a stylized set of moves for beating the bejeezus out of someone, or several someones, with a stick. At any rate, walking around with a flute is a bit more subtle than a four-foot long, razor-sharp Chinese long sword.”

“Okay. From now on I’m just going to assume that anything about you that doesn’t make any sense has something to do with beating the crap out of people in ways I’ve never even thought of. You’re kinda scary.”

“Yeah, but I’m on your side, remember?” she said, pulling tight on the arm that she was holding.

They walked a few more blocks and then she turned down Cedar Street. Ahead of them was the dumpster. Alan lifted the cover and looked in, shining his keychain flashlight into the depths of the dumpster. There at the bottom was the computer backpack. He tried to reach in and get it but couldn’t reach.

“I guess it makes more sense for me to go dumpster diving and leave the one out here who knows how to fight,” said Alan.

“You said it, not me. Here,” she said, joining her hands to give him a boost up. “If I hit the dumpster with the flute, stay inside.” With her help he scrambled over the lip of the dumpster and slid down into the trash at the bottom. It was, as Greg had said, only about a quarter full but it wasn’t all dry trash either. Alan picked up the backpack and was about to call out to Jennifer so he could hand it up to her when he heard the clank of the wooden flute hitting the dumpster. Then he heard rough voices, more than one he thought, saying something to Jennifer.

Standing on some the more solid trash he was able to get high enough to peek out of the dumpster and he saw three Grid Co security guards walking toward Jennifer. “You think that’s her?” one of them asked the other two. “Dunno. They said she’d probably be around here somewhere and I don’t see any other reason for a pretty young lady like this to be hanging around a stinky dumpster like this in the middle of the night.”

“What are you talking about?” asked Jennifer, putting on a ditzy girl voice. “I’m just waiting for my boyfriend. He’ll be here in a minute to take me to rehearsal, see.” And she put the flute to her mouth and played a short Chinese-sounding tune. Alan wondered whether everyone who learned the Flute Form had to also learn how to play the flute. “Anyway, he finds you bothering me, he’s going to make you sorry; he knows kung fu.”

“Bullshit,” said the third guard. “She matches the description we’ve got. Let’s take her in.”

“What?!” shrieked Jennifer incredulously, still in character and hugging the flute in front of her as if it would protect her. But Alan noticed that she was also sliding one hand down to the end of the flute and moving her feet into the same stance she had taken when demonstrating her Tai Chi to him the other night. The third guard, despite thinking on the one hand that this was the dangerous Underground terrorist he had been sent to apprehend also had another part of his brain that was falling for Jennifer’s scared girl act. He walked up to her like he was going to grab her by the arm and take her away. But he didn’t get that far. As he took his first step, Jennifer took a step too and the flute lashed out, striking him on the temple and dropping him to the ground instantly, a trick Alan had thought only worked in movies and bad novels.

The other two security men watched in stunned amazement for a beat and then launched into a semi-coordinated attack but Jennifer was too quick for them. As one

guard reached for to grab her up high, she ducked down swinging the flute around in a wide arc to smash into the side of the other guard's knee. Alan heard a crack that he didn't think was the flute breaking and the guard's knee collapsed inward and he crumpled to the ground. From there Jennifer rose up onto one leg with the flute describing another arc, this time passing straight up through the bottom of the remaining guards jaw, knocking his head straight back and he collapsed unconscious. While the kneecapped guard was writhing on the ground she quickly frisked the unconscious guards. They weren't carrying handcuffs but each had a package of heavy-duty zip ties that they could use as quick-and-dirty restraints. She quickly pushed the kneecapped guard onto his belly and pulled his hands behind him and zip-tied them together. Then she zip-tied his ankles together, causing him to scream out when she pulled his knee straight. Which reminded her to gag him—with a small pocket knife she cut several a long strips of cloth from his jacket and wadded most of them into his mouth and then tied the last strip around his head to keep them in.

"You can come out now," she said to Alan, as she bound and gagged two unconscious security men in the same fashion. He swung the computer backpack onto his shoulders and managed to climb out of the dumpster using the pile of trash and the fact that the wall of the dumpster was slightly sloped away from him.

"Now let's get these guys out of sight," she said, once he was standing outside the dumpster. So he had to help her lift the security men up and dump them into the dumpster. The kneecapped guard was the biggest of the three and, having passed out from pain by the time they got to lifting him, was pure dead weight. They were barely able to get him up over the lip of the dumpster but managed somehow.

Then, figuring it would be hard to pass as two young lovers out for a stroll with Alan smelling like a dumpster and covered in small bits of trash that had stuck to his clothes, they both started running back to Ms. Liu's house. Jennifer soon had to slow to a jog to let Alan, who was still wearing the computer backpack, keep up but they got back to the house without seeing anyone else.

When she opened the door, Ms. Liu took one look at them and a small sniff of the odors wafting off Alan and said, "You go see your friend," to Jennifer, "he's in the living room. And you come with me." She led Alan to the bathroom and handed him a plastic laundry hamper. "Put your clothes in here and get in the shower." She then slipped out of the bathroom and Alan stripped, dropping his clothes into the hamper. Once he was in the shower he heard the bathroom door open and the hamper being taken out.

He cleaned himself quickly and got out. He found a robe hanging on the back of the door. It clearly wasn't Ms. Liu's but it still was quite a few inches to short for Alan, reaching only to just above his knees. But what choice did he have.

"Sexy," said Jennifer, when he arrived in the living room. Greg was propped up on the sofa, with some bandages on his face, eating. He was also wearing a robe, Ms. Liu having divested him of his bloodstained clothes somewhere along the way, but had the advantage of also being covered in a blanket. Around him were plates and plates of Chinese food Ms. Liu had prepared while Alan and Jennifer had been out. She quickly brought bowls and chopsticks for them too and they began to dig in.

"I seem to keep asking this but, now what?" said Alan. "They've got Bryce and Mr. Green and we've got—what, the computer and two backpacks full of books? I don't have any more close sysadmin friends who can get us on to the sysadmin level let alone down to the sub-basement. Plus I'm pretty sure that any of us who shows our face at Grid Co's offices is going to join Bryce and Mr. Green pretty

quickly."

"Well, see, we do have one way to get to the sub-basement," said Greg with a grim laugh.

"Actually," said Jennifer, "that's not entirely stupid."

"Yes, it is!" exclaimed Greg. "It was a joke. It's called gallows humor."

"But if we can get one of us in, somewhat on our terms, we may be able to get the others out."

"What are you imagining?" asked Alan.

"I don't know," replied Jennifer, with a frustrated look. "But there's gotta be a way we could put it to use."

"You're F.N.—fucking nuts!" said Greg.

"Wait," said Alan, "Mr. Green told us if something happened to find José. Shouldn't we do that?"

"Do you think he's up at this hour?" asked Jennifer.

"If he's really going to be willing to help us, he'll probably be willing to get out of bed, no? I'm pretty sure he lives in that warehouse. Let's go."

"You gonna go like that?" asked Jennifer, pointing to his knees sticking out from under his robe.

"Oh, yeah. That's a problem." Just as Alan was pondering which would be more terrible, having to wear his dumpster-perfumed clothes or having to go ask Ms. Liu to have them back so he *could* wear them, she came in with a stack of clothes. Not his and Greg's but ones that would at least fit. Greg got a pair of jeans and a hooded sweatshirt. For Alan the only clothes she had been able to find in anything like his size were a set of silk pajamas—not sleeping pajamas, but the kind old Chinese people used to wear.

"Well, at least now you *look* like a real Tai Chi master," said Jennifer, when he put them on.

"Whatever. Let's go. You okay, Greg?"

"I'll make it. Anyway, beats crazy girl's plan."

Alan hoisted the computer bag back on his back, not knowing whether they'd need it, and Jennifer retrieved the Tai Chi flute thinking they might. Ms. Liu came back into the room with a small bag she handed to Greg. "Snacks—you never know when you'll get hungry. Now, you should go. If Mr. Green comes, I will tell him where you are. Good luck."

Chapter 28

They spent a while getting reoriented—they had only gone to José's from Mr. Green's house, and had only been paying partial attention to how to get there. But they didn't want to go back to his house in case there were more Grid Co security agents waiting. Finally, after some bickering between Jennifer and Greg, they picked up what they all agreed was the trail to José's.

As the walked along, Greg started poking around in the bag of snacks to see what Ms. Liu had packed.

"Are you seriously hungry again? After the Chinese feast we had back at Ms. Liu's?" asked Jennifer.

"No, not really. Just looking around—holy shit, look at this!" Greg looked around to make sure there was nobody but them around and then held out the snack bag, pulling it open and pushing aside the bags of shrimp chips and Chinese cookies that filled the top of the bag to reveal that the bottom of the bag was filled with cash.

Jennifer poked her hand into the bag and felt around. She pulled one stack of bills out and looked at it. "These are twenties. There must be a few thousand bucks in there. 'Might get hungry' indeed." She stuffed the bills back into the bag and covered them up with the snacks.

"Maybe she knows José too—despite Mr. Green's confidence that he'd help us out, I'm not so sure a few thousand in cash wouldn't speed up that help," observed Alan.

They soon arrived at the alleyway door to the warehouse and pushed it open. It was pitch black in the warehouse which made navigating the maze almost impossible. Alan pulled out his keychain flashlight but it could only illuminate a small patch at a time, barely enough to pick out their way through the maze of warehouse detritus. Alan wasn't even sure he could do it with all the warehouse lights on.

Then they heard a noise behind them. "José?" asked Jennifer. No reply. Then another noise, that sounded like footsteps. Alan saw Jennifer dropping into her ready stance and adjusting her grip on the flute and shrugged off the computer bag, determined to be of some account for once if it came to another episode of physical combat.

"Give us the money!" said a voice in the dark. Alan shone his light in the direction the voice came from and they saw two pale men, obvious meth addicts, with scabs on their faces, long lanky hair and incredibly bad teeth. One of them was holding a short knife and the other a length of chain.

"Yeah, we heard you talking about it. Hand it over," said the chain wielder.

Greg took a step back with the bag and Alan took a step forward. But Jennifer was still in front and she was the one who said, "Oh, yeah, tough guys. Come and get it. Hope you just dosed up on your nasty speed because otherwise I'm going to be way too fast for you."

The guy with the chain had to take a moment to get it twirling around his head but the knife man came charging at Jennifer. She lifted her back leg up so her toe was pointing at the knee of her other leg which allowed her to stretch out the arm holding the flute and bringing it snapping down onto the meth head's wrist of the hand holding the knife. For the second time in the evening, Alan heard a sharp crack as the meth head dropped the knife and grabbed his wrist. Alan could see the hand

hanging limply from it and, figuring this was his big chance, tackled the guy, flipped him over on his belly and chicken winged the arm with the bad wrist up behind the guy's back.

Meanwhile the chain guy had got his chain up to speed, whirling around over his head and he charged Jennifer. She simply stuck the flute up and let the chain wrap itself around the flute several times and then jerked hard, pulling the meth head off balance. While he was occupied trying to understand what had just happened, she kicked him in the groin, leaving him also writhing on the ground.

"Nobody move!" shouted an irate new voice. Alan, still sitting on the first meth head's back, turned toward the voice and saw José pointing a sawed-off shotgun in the general direction of the mélée. "What the fuck goes on here?" he demanded. Then he recognized Jennifer and took another look at Alan and Greg. "Ah, the hackers. But who are these yahoos?"

"Muggers. Blackguards. Highway men." answered Jennifer.

"Don't flatter them. Bunch of crank addicts if you ask me. Go on! Get your scabby asses out of here," he shouted pointing the gun now at the two meth heads. Alan, seeing the barrel of the gun swinging his way, let go of the meth head's arm and jumped off. The two would-be muggers struggled to their feet and hobbled out of the warehouse. José held his gun pointed in the direction they had left until he heard them open the alleyway door and go out.

"Where's Green?" asked José.

"Grid Co caught him," said Jennifer. "He told us if they got him, we should come see you."

"He did, did he?" grunted José. "What on earth for?"

"He *seemed* to think that you would help us help him," said Jennifer, with a touch of asperity in her tone.

"Now, why would I do that. What do I want with messing around with Grid Co. They less they know I even exist, the better."

"Well, he certainly knows you exist," pointed out Alan. "And he's with them now. As Jennifer can tell you, they're not above a little torture to get the information they want. So maybe your best bet is to help us get him out before he's forced to tell them all about you."

"Fuck. That's an excellent point, I must admit. And you clowns are clearly never going to spring him without my help. Alright, let's go inside." He waved them toward what they could now see was the door to his shack.

When they were all seated in sitting room where he and Mr. Green and waited the last time the other three had been using the terminal, José said, "I'll assume you have no actual plan for getting Green out, right?"

"No. He seemed to think you would have some ideas," replied Jennifer.

"I'm full of ideas," said José, sarcastically. "But let's hear what, if anything, you bring to the table. Because my first idea is that a frontal assault on the Grid Co is lunacy. If that's the only option we've got, I might as well just pack up and go on the run now."

"Alan," Jennifer started, pointing at him, "works at Grid Co."

"Good."

"They may be on the lookout for me," added Alan, "but I still have my ID and my keys."

"Bad and good."

"Jennifer, as you just saw, can fight," said Alan.

"And you two," replied José, gesturing at Alan and Greg, "as I also just saw, can't."

"Hey, I'm the guy with the Grid Co ID."

"We're pretty sure where they're holding him," Jennifer interrupted. José started to say something snarky to the effect that everyone knew about their secret holding area, but barreled on, "And we know how to get down there. They took me into custody two nights ago and these guys and Mr. Green and another friend of ours, who's probably being held now too, busted me out." She then explained the details of her escape from the Grid Co dungeon with Alan and Greg filling in various details.

"Well, that's a start. Though with our only friendly sysadmin currently in the hoosegow, it's not clear what we can do with that experience. What else?"

"And Greg," added Jennifer, has put a backdoor into every public Grid node on the planet that only we know about.

"*Now* we're getting somewhere. That's actually something we can work with. What can you do with it?" he asked, turning to Greg.

"Pretty much whatever we want," answered Greg. "There was an exploitable bug in the inter-node communications code. We, for reasons not entirely worth going into, patched the bug to stop a certain monkey-wrencher from monkey-wrenching the whole Grid and while we were in there, saving the Grid, we put in the backdoor. So we can run anything we want at the same extremely highly privilege level as the inter-node communications code."

"Hot damn! Now we're really talking."

"Wait. What? How is hacking the Grid going to get Mr. Green out of a actual physical detention center," asked Jennifer, looking sincerely confused now.

"No, I think I get it," said Alan slowly. "We may not even be able to get into the building, as things stand, if they're looking for me, let alone all the way through the sysadmin level down to the dungeon. But what if we could throw all of Grid Co into total chaos?"

"Then we'd have a pretty good chance," exclaimed Jennifer.

"Don't get excited sweets," murmured José. "You'd have *a* chance—I wouldn't go so far as 'pretty good.'"

Greg got up off his cushion and started unpacking Mr. Green's computer and the printouts, still divided into the three piles according to Alan's first pass through them, handing the two top piles to Alan and Jennifer. "Well, that means we need to finish our hack—find the code we need to hack to seed our virus *and* write the virus."

"Hang on, a virus?" exclaimed José.

"Yeah, why? We want to throw them into chaos, right? What better way than to give them a virus outbreak to deal with?"

"Yeah. No. That's great. But what's the virus going to do?"

"Well, we haven't written it yet—come on José, try and keep up," teased Jennifer. "But when we're done, whatever we want."

"Dios mio!" breathed José. "This is it. You can crack open the Grid once and for all. You bet your sweet asses old Grid Co is going to be in chaos if you can pull this off.

"You know what Green has been trying to do all this time—free our 'intellectual heritage', as he always puts it. I give him a hard time about it but that's because I'm a cynical bastard without the kind of energy he has for lost causes. But that's what we all want. And you're going to do it. Fuck yeah! Shit—you guys stay here and do your hacking thing. There are other black market terminal ops who'll want to help with this. I've got to go talk to them. With their help we can blast this virus at them from every direction at once. More chaos, better chance it'll work."

“Will they really help us?” asked Jennifer. “I’ve met some other ones, beside you, and ‘cynical’ doesn’t begin to cover it with most of these guys.”

“Some will. Everybody would be glad to see the Grid Co take it in the pants but some of them won’t lift a finger to help if there’s nothing immediate in it for them.”

Greg raised his eyebrows and looked at Jennifer and Alan who exchanged a glance and then nodded at Greg. “Here,” said Greg, handing José the bag of snacks from Ms. Liu. “Maybe use this.”

“Uh, these guys work for a little more than peanuts,” said José, pulling out a bag of roasted nuts.

“Keep looking,” suggested Jennifer.

In a second José gave a gasp and then upended the bag over the low table and stared at the small pile of cash sitting surrounded by packaged snacks. “Okay, now there’s a lot more folks I’ve got to talk to. You get to work. I’ll be back in a couple of hours.” He picked up the money and smiled. “I’ll leave the snacks in case you get hungry.”

Alan was already working his way through the pile of code he had identified as most likely to contain the programs the sysadmins used to update the master Grid system code. If he could just find it then they might have a chance to hack a version that bypassed the normal administrative checks and installed the virus in some low-level piece of code where it would spread everywhere. “You guys get started on the virus; I’ll find a way to get it installed.”

By this time Greg had gotten the computer assembled and running. He swept the snacks off José’s table and put the monitor on top and he and Jennifer began their high-speed back-and-forth team programming commentary that Alan could barely follow a fraction of. So he blocked them out and concentrated on his own task.

It didn’t take long to find the code. As he analyzed it, he saw that it would not be too hard to bypass the security checks, assuming he could run a hacked version of the system update program with the appropriate privileges. He wasn’t sure how he was going to be able to do that—the original plan had been that Bryce was going to run it from his sysadmin account. Then he got an idea and started digging through some of the other printouts he had skimmed earlier. In a few more minutes he found what he was looking for.

“How are you guys doing on the virus,” he asked, once he had found all the pieces he needed.

“Almost there,” answered Jennifer, without looking away from the screen where the code Greg was furiously typing was appearing. Alan took out a pad and pen and the small stack of printouts he had collected and started making some notes. “Okay, done.” said Jennifer about five minutes later. She and Greg leaned back and each took a deep breath.

At that moment José came in with a big grin on his face. “They’re in. Now we just gotta tell them what to do and when.” He brandished a fistful of thumb drives. “Just put whatever code you want on these, and we can launch it from hundreds of terminal whenever you’re ready.”

“Hey guys. I’ve got a slight change to the plans,” said Alan. “I think you’ll like this. More to the point, I think Mr. Green is going to like it. A lot.”

“Change what? Why?” asked Greg, with some aggression in his voice. “We’ve got a plan and we should stick to it until our friends are out of danger.”

“Just listen. This is actually better for getting them out and, if it works, just all-around better. What did we agree we need to help get them out of the Grid Co dungeon?”

“Chaos,” answered Jennifer helpfully. He gave her a grateful smile.

“Right. And we need it right away. We should launch the virus essentially now, from José’s terminal and all his friends’ terminals and just flood the Grid with crap they have to deal with. The virus doesn’t need anyone to run anything as sysadmin to get it propagating, just your backdoor, right Greg?”

“Right, but—”

“No, I get it. If we do that, they’ll eventually find the backdoor, close it, stomp out the virus, and then we’re right back where we started with no more backdoor and no more virus and the Grid just as hard to penetrate as ever. But that’s just the first part of the plan.

“You guys know who Turing was, right?” They all nodded. “But do you know about the Turing Award? It used to be the most prestigious prize in computer science. Anyway, one year—more than a century ago—the winner, a man named Thompson, gave a lecture called ‘Reflections on Trusting Trust’ about how he put a backdoor into an operating system he was working on. I think we can use the same technique.”

“But we already *have* a backdoor,” said Greg, exasperatedly. “We don’t need a backdoor—we need to plant the virus so they can’t get rid of it.”

“Exactly! That’s exactly what we’re going to do. Just listen. Thompson started by putting a backdoor into the program called ‘login’ that managed allowing users to log in to the system when they gave their name and password. The backdoor was simply a hard coded username and password pair. All well and good except this system came with the source code for all its programs, including the login program and it was possible that someone might recompile login, maybe after making a small change, or just because. But he couldn’t distribute the hacked version of login—people would notice the backdoor. So Thompson put a second hack into the system, this one into the compiler for the language that all these system programs were written in.

“This hack allowed the compiler to recognize when it was compiling the unhacked version of login—as long as it hadn’t changed too drastically from the original version—and to insert the backdoor into the generated binary version, *as if* the backdoor code had been in the source code.”

“And that worked because they didn’t have the source code to the compiler, I get it. How, exactly, does this help us?” sneered Greg.

“No, actually they did distribute the source code to the compiler too. But Thompson put a *third* hack in. This hack was also to the compiler. It made it so the compiler would also recognize when it was compiling an unhacked version of itself and insert the two hacks, into the generated binary of the compiler: the one that made it generated hacked version of the login binary and the one that generated a hacked compiler. Thus no matter how many times people recompiled the system, they would still end up with a hacked login program even though there was no evidence in the source code they got of the hacks. The only way out was to write a whole new compiler that was different enough from the old one that the hacked compiler didn’t recognize how to put in the hacks.”

“That’s a sweet hack kid,” said José, “But so what?”

“Don’t you see? We can do the same thing to the Grid. While they’re dealing with the chaos from the first wave of the virus, a virulent, immediately destructive version that we launch from the black market terminals, we can get into to Grid Co and spring Mr. Green and Bryce. Then Bryce can help us run some code as sysadmins. We modify the system update installer as we discussed earlier, so it puts the virus into some low-level code that runs all the time. But then we also hack the system update installer to reinsert that hack and this second hack into the system

update installer if anyone tries to update *it*. And for good measure I've figured out how to hack Grid Co's compiler to insert the hacks back into the system update installer and into itself should they try to recompile things. They'll be in exactly the same situation as Thompson's victims.

"But this virus doesn't have to be virulent and destructive; we'll already have unleashed enough chaos. Instead it can be slow spreading and not do anything at all except spread until some time has passed. Then, in a few months, after things will have settled down, it can slowly start grabbing bits of the Library and dropping them in encrypted lumps on various nodes where we can pick them up and save them. In fact, we don't even have to figure out now how to do that, we just write a first version that can pick up new versions of the payload code in future and figure out later what we want to do with it."

"Can that really work?" asked Jennifer.

"Well never know until we try," said José. "Sounds good to me, let's get going."

Chapter 29

The four hackers—for it turned out that José was also a pretty skilled programmer—settled down to do write the programs Alan had described. José and Greg, working on José's terminal, which was a computer similar to Mr. Green's, took the worm code Greg and Jennifer had already written and made two versions. The first would spread as fast and obviously as possible so it would bring the Grid to a standstill, something, ironically, very much like what they suspected Ronnie's thwarted worm attack would have done. The second was the more subtle worm that would spread slowly and not do anything else for several months, at which time it would start looking on infected hosts for a file that would contain new code for it to run.

Meanwhile, Jennifer and Alan used Mr. Green's computer to write the series of hacks Alan had outlined. Their task was somewhat harder than Thompson's original as they had only the machine code versions of the programs in questions. But between Alan's mastery of reading machine code and Jennifer's prodigious coding abilities, they were up to the task. When they were all done, they all swapped code and checked for bugs. Then they tested everything as well as they could on the node simulator on Mr. Green's machine. It seemed like it would work.

José copied the software for the virulent worm onto the thumb drives given to him by the other black market terminal ops. "When should I tell them to launch this thing?"

"I'd say as soon as possible," answered Alan. "Get it running now overnight and hopefully by tomorrow morning when the office opens the chaos will be in full swing."

José left without another word taking the thumb drives with him. "I'll be back in a few hours. There may be some blankets in that trunk over there. Sorry, no guest accommodations."

The other three found that there were indeed a couple musty blankets in the trunk and prepared to go to sleep. "Dibs on the couch!" said Greg, grabbing one of the blankets and flopping down. Alan and Jennifer pushed together some cushions and lay down on them with the other blanket.

They woke up in the morning to find José making coffee with an ancient French press and electric tea kettle.

"Morning, campers. Looks like chaos reigns—I can barely even get on the Grid from my terminal, things are so clogged up and they've been sending out urgent notices all morning about outages and the official price for immediate use cycles has shot up one thousand percent from what it was last night. Here's coffee. Breakfast is in the bag." He pointed to a brown paper bag with some grease stains starting to soak through.

They gobbled the pastries they found in the bag and drank their coffee and then were ready to go. Alan hoped to arrive at Grid Co at the busiest point in the morning so the security guards would have the least chance to notice them, so he hurried them out of the warehouse and set off for the Grid Co offices at a brisk walk.

When they arrived at the offices, he could see that his worries about carefully timing their arrival were misplaced. It was a madhouse. People were being called in from vacations, from branch offices, everywhere, it seemed to work on the

problems the worm was causing. Alan tried to imagine if he had never met Jennifer and Greg and Mr. Green and Ronnie had unleashed his worm, how he would have been just another good little Grid employee trying to help put out the fire. Now he was getting ready to throw some gasoline on it. The walked into the office building with a clump of bleary-eyed sysadmins returning to the office on short notice, exciting no notice at all from the security guards, and were quickly on their way down to the sysadmin floor. As Alan had expected, things were even more chaotic down here. The guard at least noticed them trying to come in: "Hey, you can't come in here—your badge is just for upstairs."

"Come *on* man!" shouted Alan. "This is not the day to get stuck up on petty details. They sent us down to help out—those guys don't have time today to come fetch me. They need *this* right now!" And he held up the disk José had given him. That was good enough for the guard and he let them through. Unfortunately the hallway to the server room, where the door to the sub-basement was, was quite a bit busier today. Luckily the sysadmins going in and out weren't paying much attention to them and they were able, with Jennifer and Alan, keeping watch, to give Greg the few seconds he needed with his lock picks to get the door open.

When they got to the bottom of the stairs, they paused to take a breath. Then Jennifer put her hand on the knob of the door. "Ready?"

Alan and Greg nodded. She pushed open the door and jumped out into the hallway, figuring at this point surprise was their best bet. But there was no one there. "Nobody here," she said as the other two came through the door. "Makes sense I guess—they've got plenty of stuff to deal with upstairs. Let's find them." Alan walked down the hall of cells and shone his flashlight into the window in the door of each cell. In the last cell he checked he found Bryce's, looking pretty beat up. "Greg! Get this door open."

When they got Bryce out he looked at them thankfully and said, "I tried to hold out as long as I could. But I had to tell them Mr. Green's address. I was so sorry when I heard them bringing him in."

"No worries, buddy. We're going to get you both out of here. Where is he?"

"They took him for more interrogation in the middle of the night. If he's not in one of these cells he must still be with them."

"Crap. Well, let's go get him. Can you walk?"

"I can limp along. The busted up my knees pretty good the first day. But the've since moved onto my fingers. He held up his hands which were a like two purple balloons. Alan winced.

They walked down the hall toward the interrogation room until they came to the corner. Jennifer peeked around. "No guards." But then they heard the smack of a fist hitting a face and heard Jeseki's voice, shouting. Jennifer sprinted around the corner and threw open the door to the interrogation room to see Jeseki winding up to hit Mr. Green in the face again. "Tell me how it works, damn you! I know you had a hand in this!" She grabbed his upraised hand and spun him around. He stared at her with wild eyes and spittle on his chin.

"Actually, no, you'd want to be asking *us* that question," she said, still holding his hand. Then she twisted it around and his body followed, slamming hard into the floor. Greg ran to pick the locks on Mr. Green's handcuffs while Jennifer improvised a gag for Jeseki out of his socks and belt. Once Mr. Green was free she took the cuffs from Greg and snapped them viciously onto Jeseki's wrists. Mr. Green put his arm around Greg and Alan's shoulders and they half-carried him down the hall as Jennifer took Jeseki back to Bryce's cell, threw him in, and slammed the door shut.

“Bryce, we have some code we need to run as a sysadmin,” said Alan. “Do you think we can do it?”

“Sure,” said Bryce. “But we’ve got to get up to my office.”

“Easier said than done,” said Greg. “That hallway upstairs is swarming with sysadmins. I think they’ll probably notice if we pop out with you and Mr. Green, looking the way you guys do.”

“Sure, they’ll notice. Maybe they should notice. I’ve got an idea.” A few moments later they were at the top of the stairs and Alan was pulling out four heavy duty zip ties, from the pack Jennifer had brought with her. “We just brazen our way through—Greg, you and I are guards, try to look tough. Everyone else is a prisoner. We’re leading you somewhere. Everyone will see us but nobody will have time to check on where we’re going. Put a zip tie around your wrists, but not too tight. Can you handle it guys?” he asked Mr. Green and Bryce.

“If some one can do my wrists, I can stand it,” said Bryce. And Mr. Green nodded and forced himself to his feet without assistance. Jennifer looked skeptical but put a tie around her wrists and pulled it tight with her teeth.

Once everyone was ready, Alan opened the door and led them out, marching briskly down the hall as if they belonged there. He led them to Bryce’s office but discovered it was locked. There were too many people around to risk Greg trying to pick the lock but then a guard came by and Alan decided to go for broke. “You there—we need to get into this office right away. This prisoner just revealed that there is information about the worm attacking the Grid in this office. Hurry!”

Having been yelled at all day by various cranky Grid managers, the guard was fully conditioned to obeying imperious orders and instantly used his master key to open Bryce’s office without any asking any questions. Alan led everyone inside and then shut the door. Greg found some scissors on Bryce’s desk and cut off all the zip ties while Alan pulled out the disk containing their hacked programs.

“Okay, Bryce, very much like we planned, but with a little wrinkle we’ll tell you about once we’re out of here. We need to run the code on this disk with sysadmin privileges. Can you get us in?”

Bryce gave him his username and password and Alan typed it carefully into the terminal on Bryce’s desk. “Shit. Shit. Shit,” he cursed: “Account cancelled.”

“Hang on, I’ve got another password. I hope this doesn’t get him into too much trouble, but I know another admin’s password—he gave it to me the other day so I could run a job he was supposed to have kicked off. I think he had snuck out with his girlfriend. Anyway, if he forgot to change it, we can get in. This time when Alan hit enter, he was immediately logged in. He put the disk into the terminal’s reader and ran the program he and Jennifer had crafted. It was a script that automated the process of installing the virus and all the hacked versions of the system programs needed to silently preserve the virus on the Grid systems until the next time they wrote a new compiler, which, in the normal course of events, should be never.

When the program completed, Alan pulled the disk from the reader and logged out of Bryce’s friend’s account. Then he held up four more zip ties and said, “Okay, let’s get out of here.” Once everyone but he and Greg were cuffed back up, he led them out of Bryce’s office, past the guard station, up the stairs, and to his office. There he and Greg removed the zip ties and they all walked out the door. Once they were a block away from the Grid Co offices, Mr. Green collapsed and Greg and Alan had to make a chair with their hands and carry him to José’s warehouse. Jennifer helped Bryce hobble along behind.

They stayed with José for a few weeks while Mr. Green and Bryce recuperated from their ordeal. Jennifer, Alan, and Greg cobbled together some more rooms out of the detritus in the warehouse and ran some extension cables from José's stolen power lines so they could set up Mr. Green's computer. When a month had passed, they used José's terminal to upload the first payload code for their now active virus. Within days they started retrieving boluses of encrypted data from various nodes on the Grid. With José's help they were able to scrounge up more hard drives to store the data and Mr. Green began sifting through the downloaded data and distributing copies in various forms. One day he cried out and Jennifer and Alan, who were in the next room, rushed in.

"What's the matter?"

"Nothing! Nothing at all. Look at this. He pointed at the screen, where the words, "The Complete Works of William Shakespeare" appeared.